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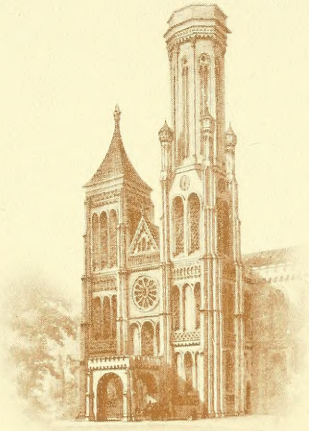

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THE

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AN ILLUSTRATED MONTHLY

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THE NATIONAL GEOGRAPHIC MAGAZINE

HOW THE WORLD IS FED

BY WILLIAM JOSEPH SHOWALTER

AT THE present juncture, while great issues of world politics hang critically upon the effort of the Entente Powers in the European war to force the Central Powers into submission by drawing around them the steel ring of war and the cold ring of hunger, it is more than interesting to take an inventory of the world's market basket, and to pause for a passing moment to see what effect war has had on the world's food supply in the past, what effect it is having today, and, if possible, to forecast its effect upon the future food problems of the earth.

If we go back one hundred years it will be discovered that France was facing almost the same problems then that Germany is facing today. England's fleet blockaded France's ports then just as they blockade Germany's today, and over-sea foodstuffs had little chance to reach the French.

How far this went, and how great an effect it had on conditions in Napoleon's Empire, is revealed by the fact that sugar sold for two dollars a pound. And that the world is not sugar-hungry today is due to the steps taken by Napoleon to overcome the effect of the blockade on sugar. Years before, some Prussian scientists had been trying to get sugar from the beet, and, under the patronage of the King of Prussia, Frederick William III, succeeded in their task.

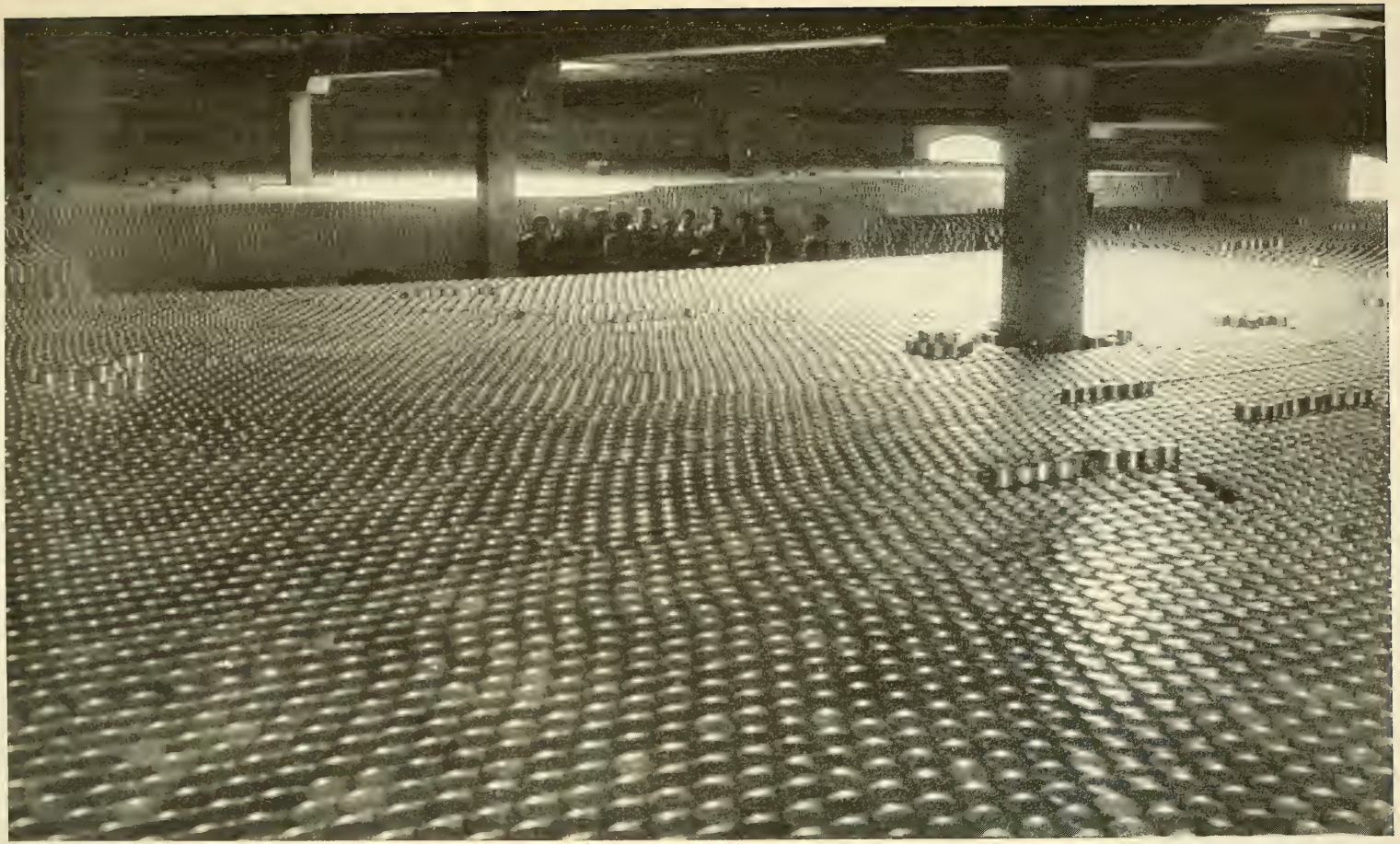
Napoleon borrowed their ideas, set up beet-sugar factories around Lille, and gave to the beet-sugar industry that impetus which has resulted in its development to a point where it yields half of the world's supply of sugar (see page 86).

WAR AND CANNED GOODS

The Little Corporal saw himself seriously embarrassed in the matter of food supplies for his army. He wanted something for his men besides things that were dried or smoked—a desire that was enhanced by his knowledge that millions of dollars in valuable but perishable foods were wasted because of the lack of adequate means of preserving them.

He therefore offered a prize of twelve thousand francs to any one who would devise a practicable method of preserving such foodstuffs. Such a method was quickly evolved, and out of it has grown the world's canning industry—one of the important steps that civilization has taken in the direction of insuring mankind against famine (see also page 66).

It is not improbable that the present war will bring to mankind new methods in the feeding of the race that will prove as important as those brought out by the Napoleonic wars. It has been announced lately that the Germans have devised a new synthetic method of producing protein. It is said that they feed yeast with a combination of sugar and nitrogen from the air, and thus secure that most important of all of the elements that enter into the world's diet—protein. Examples of protein are the whites of eggs, the



Photograph by Curtis & Miller

CANNED SALMON IN THE WAREHOUSE READY FOR DISTRIBUTION

Some of the most important advances man has made in his food supply have been the result of war. Napoleon's bounty brought about the development of the art of canning foods (see page 1). Before his day not even the scientist in his laboratory could "put up" a can of food; today there is not a rural housewife so unscientific as not to be able to do so. The commercial canneries of the United States alone now produce about twenty cans of fruit and vegetables and five pounds of canned fish and shellfish for every man, woman, and child in the country. And this takes no account of that vast quantity of fruits and vegetables canned by the millions of farmers' wives in their own homes. The tens of thousands of cans in this warehouse, which make the men in the middle background appear lost, give some idea of the magnitude of our fish consumption, which, however, is smaller per capita than that of most nations.

muscles of meats, the casein of milk, the gluten of flour, and the nitrogenous fats.

It may also happen that as a result of the war will come the utilization of other plant products than those now entering into direct use as human food. There are approximately half a million species of plants in the world, and yet only a few thousand of them are used at all for food, while only a few hundred of these are used to any important extent. Some of the plants which we now grow are expensive food-producers, some produce food that is difficult to digest, and some give a small yield per acre.

DEVELOPING NEW FOODS

We are constantly developing new foods. It is only little more than half a century since the tomato was a curiosity of the South, known as the "love apple," and used to scare the slaves, who thought it poisonous. Corn came to us from the Indians, and has become one of the leading cereal crops of the world. It is less than a century ago that the lima bean came to us from South America, and the potato was unknown to civilization before the white man went to Peru and Colombia (see page 42).

Today representatives of all of the leading nations are scouring the remote places of the earth for crops which promise to increase the world's total yield of food, as well as its per-acre production. In our own Department of Agriculture we have a division which has brought perhaps 40,000 different kinds of plants into the United States, many of them to be placed on trial as food-producers.

The Mission Fathers of our Southwest who brought the olive and the date from the Mediterranean region, gave to California some of the richest olive and date orchards in the world, while a woman missionary, traveling in Brazil, sent us cuttings from which the great orange-growing industry of our country has been developed (see page 71).

FRUITS AND VEGETABLES HAVE BEEN WONDERFULLY IMPROVED

Not only is mankind gradually increasing the possible acreage for the growing of foodstuffs—and statistics indicate that only the most fertile third of the world's potential food-producing acreage is under cultivation today—but the crops themselves are being constantly improved and their natural per-acre yield increased.

It is a far cry from the little old knotted and gnarled apples of a few centuries ago to the magnificent Stayman winesaps, York imperials, and Albemarle pippins of today; and it is also a far cry from the unimproved, small and hard peach of the olden days to the big, luscious Alberta of the present; nor is the change that has come over the potato since Burbank begun his experiments any less noted. Both in the animal and in the vegetable world a marked improvement is constantly taking place. Whether there will be further improvements as a result of the war in Europe remains to be seen.

WHAT OF THE FUTURE?

Many men are inclined to sound a pessimistic note as to the adequacy of the world's food supply for future generations, and, like Malthus a hundred years ago, are inclined to predict that the day has at last come when the human race must cease to expand its numbers, or else face inevitable hunger.

And when we consider how many mouths there are in this world to feed, and how much food it takes to satisfy them, little room is there to wonder at this note of pessimism.

The earth's population today reaches a grand total of about 1,700,000,000 souls. If they were all set down at a banquet it would require sixteen tables reaching around the globe to seat them. For every ounce of food they ate, the dinner-giver would have to provide 53,000 tons of provisions, and if the dinner were no more than a democratic dollar-a-plate affair, it would cost, in the aggregate, as much as it costs to run the United States government a year and a half.

Expressed in terms of annual consumption, the world's market basket is one that defies portrayal in weight and size. One is forced to cast around for new units of measurement to give a proper idea of its proportions. Assuming that the average inhabitant of the earth uses two pounds of provisions a

Photograph from U. S. Department of Agriculture

TOMATO PLANTS TRAINED ON TWINE TRELLISES

It is only a generation since the tomato was first accepted by civilization, and yet today millions of people regard it as an almost indispensable part of the kitchen vegetable supply. New Jersey is our leading tomato and asparagus producing State; New York leads in cabbage, onions, and sweet corn; Florida holds first place in the production of green beans, cucumbers, egg plant and lettuce; California produces more cantaloupes and muskmelons than any other State, and Texas makes its bid for vegetable-producing fame by leading the procession as a producer of watermelons.

Photograph from Rev. B. H. Johns

A DAY'S RATIONS FOR 43 BOYS: TIENTSIN, NORTH CHINA

The food for one day (two meals) is, beginning at the left: bag of wheat flour for bread, 32 pounds; bottle of sesame seed oil; little basket of sea salt; two pounds of bean curd (in wicker ladle); large stone bowl of rice, 33 pounds, and several heads of Chinese cabbage. The bundle of dried grass at the right is the fuel for preparing it.

day, the total for the year would amount to a billion and a quarter tons. It would require a string of cars, carrying thirty tons to the car and reaching eight times around the earth, to haul this material.

THE AVERAGE RATION

The fact, however, is that the average inhabitant of the earth probably uses more than two pounds of provisions a day. The steerage passengers on English ships are allowed 2½ pounds each a day. Even the prisoner in the average jail gets more than 2 pounds; the Russian conscript 4 pounds; and the Austrian common soldier 2½ pounds a day.

Still another way to get an idea of the size of the world's food problem is to assume that the average individual consumes ten cents' worth of food daily. On this basis it would require the entire national wealth of the United States, the richest nation of all history, to pay the world's food bill for twenty-six months. For every cent per day per capita that the cost of living increases, more than $6,000,000,000 is added to the world's annual market-basket expense.

STARVATION STILL REMOTE

But when one considers the possibilities of future food production, it is difficult to have much faith in the prophecies of pessimism of these twentieth-century successors of Malthus (see also page 91).

For instance, in the United States we have 935,000,000 acres of arable land, only 400,000,000 of which are under cultivation. Yet, with less than half of our available land utilized, the United States produces one-sixth of the world's wheat, four-ninths of its corn, one-fourth of its oats, one-eighth of its cattle, one-third of its hogs, and one-twelfth of its sheep.

Even with the land now under cultivation, if we produced as much wheat per acre as England and Germany, we could supply the world with two-thirds of its flour. If we produced as much corn to the acre as they do, we could double the world's supply of that product.

Today the United States has a total

Photograph by Curtis & Miller

SHEEP IN AN IRRIGATION DISTRICT: WASHINGTON STATE

"Taking the world's supply of sheep, cattle, and hogs, and making proper allowances for less improved methods of stock-raising on other parts of the globe as compared with those of the United States, it appears that mankind at large uses in the neighborhood of 47,000,000,000 pounds of meat a year," which is about 49 pounds per capita, as compared with America's 172 pounds (see text, page 12).

cereal crop of 5,000,000,000 bushels. Were all of our arable land under cultivation and producing only according to our present standard, which is less than half as high as that of western Europe, we could add enough cereals to take care of an additional population the size of that of Europe (see also page 91).

LITTLE ROOM FOR PESSIMISM

When one has lived on land, as the writer has done, which, at the end of the Civil War, did not produce more than eight bushels of wheat and twenty bushels of corn to the acre, and has seen this land produce as high as forty-five bushels of wheat and a hundred bushels of corn, it is difficult to take any other than an optimistic view of the possibilities of American agriculture.

Not only are there infinite possibilities yet untouched in our own country, but also in most of the other countries of the earth as well. For instance, Russia, that land for which nature has done so much, endowing it with food-producing possibilities such as few other countries possess, has a wheat yield of only ten bushels to the acre.

When the day comes, as come it certainly will, that Russia produces as much per acre as Germany and England, and when the untold millions of acres of undeveloped land are opened up and settled, as they are destined to be, alone she can supply the world's present needs in cereals except rice and corn (see pages 24 and 25).

TROPICAL POSSIBILITIES

Nor is that all. Any one who has traveled through the tropics, studying the production of foodstuffs there at first hand, cannot fail to understand that vast potential food sources still lie untouched. The wonderful discoveries of Ross and Reed and their coadjutors, of the methods of preventing malaria and yellow fever, followed by the mastery of the secrets of the bubonic plague and beriberi, and the application of these lessons in Cuba, at Panama, and elsewhere in the tropical world, have made it possible for civilized man to open up gardens of plenty of which he never before dreamed.

Untold millions of acres of densest jungles are, so far as man is concerned, nothing more than lands of infinite richness wasting their sweetness upon the desert air of unutilized opportunities.

Not long ago I visited the ruins of Quirigua, in Guatemala. The United Fruit Company had set apart several hundred acres as a reservation for the protection of the ruins. The jungle forest of the reservation, bordering the banana clearings, towered like a green wall a hundred feet high, and the undergrowth was so dense that no man could penetrate it save by cutting his way through with a machete.

There I saw the contrast between the past and the future of the tropical world. The banana plantations, stretching for miles and miles up and down the Motaga River valley, were producing millions of bunches of bananas, where but a few years before had existed the same sort of jungle as that at Quirigua.

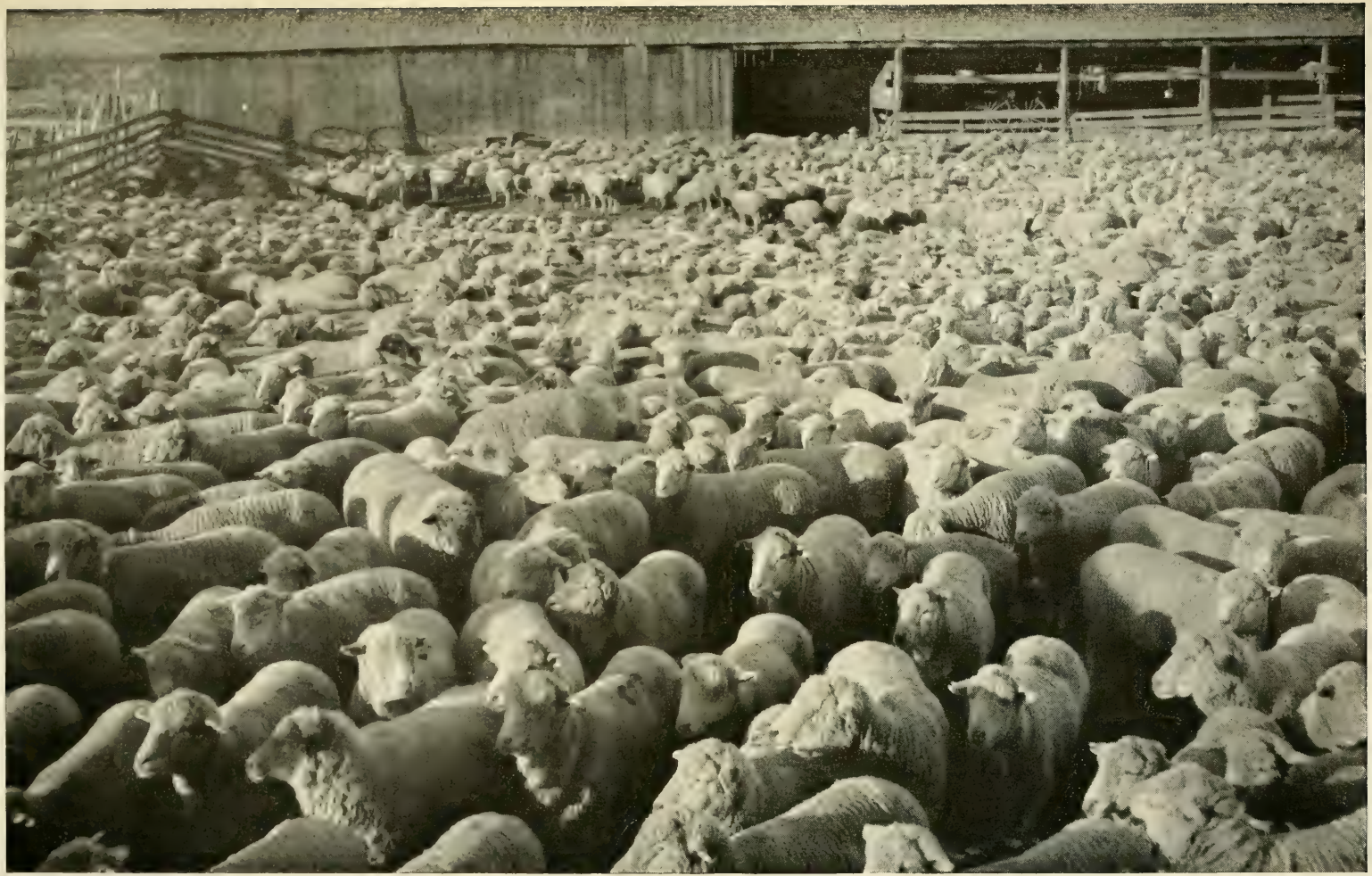
NEW PRODUCTS AVAILABLE

Not only are there vast millions of acres of potentially rich agricultural lands still awaiting development, and not only is it certain that the production per acre of those lands now under cultivation will be vastly increased, but new products are an inevitable prospect of the future.

When one travels in tropical countries he finds that banana flour makes an excellent substitute for wheat flour; and if the day ever comes when the wheat and the rye and the barley crops do not yield sufficient bread, there are hundreds of millions of acres of potential banana land which will produce many-fold as much banana flour to the acre as we are able to get today of wheat flour from our wheat lands.

One might go on at length showing the wonderful possibilities of agriculture that lie in the future. Even if there should be no other developments than those which, by experience alone, we are able to forecast, there is no question but that the prospect of the world's starvation is to all practical purposes as remote as it was in the days of the pessimistic Malthus.

But just as the forecasts of Malthus failed to consider the possibilities of the age of agricultural machinery, the age



A TWENTIETH CENTURY SHEEPFOLD

Few other nations have as many domestic animals per capita as we have. There are 31 sheep for every hundred people in the world, 9 hogs, 25 cattle, and 6 horses. The United States has 50 sheep for every hundred people, 60 hogs, 58 cattle, and 24 horses

Photograph from U. S. Department of Agriculture

SHEEP CARCASSES HANGING IN CHILLING ROOM, OR "COOLER"

"Cold storage is destined to play an increasingly important part in the handling of the world's food supply as the years go by and the demands for food increase. It is less than four decades since the first cargo of beef chilled by machinery instead of by ice was shipped, but today the funnels of refrigerator ships trace their lines of smoke upon every horizon" (see text, page 21).

Photograph by F. Lamson-Scribner

A FLOCK OF THOUSANDS OF SHEEP IN THE ARGENTINE REPUBLIC

The Argentine Republic is second only to Australia in the amount of mutton produced. It has 70 sheep to the square mile, where we have 17. It also exports more beef than any other country, having practically driven the United States out of the beef-exporting business. Where we exported 351,748,000 pounds of fresh meat in 1901, our exports in 1913 were only 7,362,000 pounds. On the other hand, Argentina's exports rose from 504,000 quarters in 1901 to 4,093,000 quarters in 1913.

Photograph by Frank H. Bothell

A FARMER LASSIE FEEDING HER COSSET

There are many little Marys and their lambs on American farms, and the lambs become as attached to their little mistresses as dogs do to their masters

of commercial fertilizer, and the age of preventive medicine as applied to live stock, so it is probable that the prophets who predict a hungry world in the not-distant future are failing to reckon with the possibilities of further extension and improvement of agricultural conditions.

Furthermore, they also entirely neglect the fact that synthetic chemistry is delving deeper into the mysteries of nature's laboratories in the roots and stalks of the plant world, and is gradually coming to the point where it can take the raw materials that the plant itself takes from the soil, and make foods in factories perhaps as well as nature makes them on the farm.

CONTINENTAL CHARACTERISTICS

In any study of how the world is fed, one discovers very soon that the various continents are characterized by widely varied forms of diet. Australia, smallest of continents, is the largest meat eater of them all. Asia, the largest continent, is the smallest meat eater among them. Africa and South America lean toward vegetarianism, while North America and Europe are large consumers of meat and other animal products.

Although Asia has fifty-three out of every hundred of the world's inhabitants living within its boundaries, it has, outside of India, comparatively few cattle, only a negligible number of hogs, and not a great many sheep. Fish, rice, and vegetables form the principal articles in the Asiatic market basket.

The average meal of the laboring class of China consists mainly of rice, a little cabbage boiled in a lot of water, and

Photograph by A. W. Cutler

A SHEPHERD ON THE PLAINS OF HORTOBAGY: HUNGARY

a small piece of turnip, pickled in brine, as a relish. From our standpoint, the Asiatic is a greatly underfed being, and yet wherever men are employed tribute is paid to the physical endurance of the Chinese coolie (see page 5).

The food of the 180,000,000 people who live in Africa is almost as simple as that of the Asiatics. It is largely vegetable, although roasted elephant foot is still one of the favorite dishes of the jungle dinner. South Africa eats largely as Europe eats, while the make-up of the North African market basket is almost identical with that of southwestern Asia.

It is probable that less than one-third of the earth's population gets what an American would call three square meals a day. Adding to the native population of Asia and Africa the Indians and half-breeds of South America, the aborigines of the islands of the sea and of Australia, and to them adding the underfed population of eastern Europe, we find that approximately 1,250,000,000 of the earth's population sit down to a scanty menu.

THE WORLD'S MEAT

Taking the world's supply of cattle, hogs, and sheep, and making proper allowance for the less improved methods of stock-raising on other parts of the globe as compared with those of the United States, it appears that mankind at

Photograph by Miller Photo Co.

ELIGIBLE FOR MEMBERSHIP IN THE ROUGH-RIDER REGIMENT

Bull-riding in Oregon is less brutal than bull-fighting in Mexico, but it is better sport, and the cowboy who herds our future beef supply is nothing if not a lover of good sport

large uses in the neighborhood of 47,000,000,000 pounds of meat a year. This would be an average of about 39 pounds per capita throughout the world. The people of the United States a few years ago were eating 172 pounds per capita, which is more than four times as much as the average for the race (see pages 10 and 15).

Next to the Australians, the American people are the largest of all meat eaters. In butchers' meat, the latest statistics showed the American to be eating 172 pounds, the Englishman 119 pounds, the German 113 pounds, the Frenchman and the Belgian 80 pounds, the Austro-Hungarian 64 pounds, the Russian 50 pounds, and the Spaniard 49 pounds. The average American eats 80½ pounds of beef, 7½ pounds of veal, 78 pounds of pork and lard, and 6½ pounds of mutton and lamb a year.

Where we eat 80 pounds of beef, the Englishman eats 56 pounds, the Frenchman 37 pounds, and the German 36 pounds. Where we eat 78 pounds of pork, including lard, the Englishman eats 33 pounds, the German 67 pounds, and the Frenchman 26 pounds.

We eat 7½ pounds of veal where the Englishman eats 4 pounds, the German 7½ pounds, and the Frenchman 8 pounds; and we eat 6½ pounds of mutton and lamb where the Englishman eats 26 pounds, the German 2½ pounds, and the Frenchman 9 pounds.

From these figures it will be seen that the Frenchman eats less than half the beef we do. He eats as much beef as the German, but less than half as much pork.

MEAT SUPPLY OF CENTRAL EUROPE

It is interesting to study the per capita production of meats in the countries of the Central Powers at the present time. The statistics of the United States Department of Agriculture reveal the fact that Germany, Austria-Hungary, Bulgaria, and Turkey had a total of approximately 50,000,000 cattle before the war began.

The Department of Agriculture says that about one-fifth of the total number of cattle in Germany are slaughtered an-

Photograph by Miller Photo Co.

THROWN BY A BUCKING BULL

We do not, like Nebuchadnezzer of old, have to eat grass ourselves, but we do eat it by proxy. We make the cattle of the ranches manufacture it into flesh for our benefit. Incidents like the one shown in the picture are the cowboy's antidote for the loneliness of the bounding plain.

Photograph from Union Stock Yards Co., Chicago

TYPICAL SCENE IN THE UNION STOCK YARDS, CHICAGO

There are about 200 cattle in the first pen in the foreground and probably several thousand in the area of the picture. The Union Stock Yards receive an average of about 7,000 cattle, 17,000 sheep, and 24,100 hogs every working day. The receipts of cattle for 1914 were 2,601,000, of sheep 5,378,000, and of hogs 6,618,000.

Photograph by Curtis & Miller

HOGS GROWN ON ALFALFA UNDER IRRIGATION: WASHINGTON STATE

The United States and Europe raise more hogs than all of the remainder of the world together. This is because of all domestic animals the hog is the least widely accepted. More than half the world still regards hog meat as unfit for human consumption.

Photograph from U. S. Department of Agriculture

STUFFING SAUSAGE IN A MODERN PACKING-HOUSE

The operatives in the sausage department have their nails manicured and their hands sterilized every time they come into the packing rooms. The factory output of sausage in the United States is worth $60,000,000 annually.

nually. Assuming that the net weight of those of Germany and Austria-Hungary corresponds with the net weight of our own cattle, and that the net weight of those of Bulgaria and Turkey is only 300 pounds where ours is 543, it would appear that there is a 34 pound per capita production of beef in the Central Powers.

There are 37,000,000 hogs in the countries of the Teutonic Alliance. The Department of Agriculture's statistics show that the annual slaughter in Germany is 110.4 per cent of the total number of hogs on hand at a given time; therefore it would appear that there is a per capita production of pork amounting to 45 pounds in the Central Powers. Based on the German ratio of the sheep killed to those found on the farms of the country at a given time, the annual slaughter of sheep in the region controlled by the Central Powers is 31,000,000.

Assuming that the average dressed weight per sheep is only 30 pounds, as compared with 41 pounds in the United States, there would be a production of 941,000,000 pounds of mutton, or 6.7 pounds per capita. This gives a total

Photograph from U. S. Department of Agriculture

INSPECTING SALT MEAT IN A BIG PACKING-HOUSE

While salt meat represents only a comparatively small share of the meat production of the United States, yet, neglecting the farm slaughter and that of the retail butcher, we produce 9½ pounds of salt pork, 8 pounds of ham, 3½ pounds of shoulder, and 7½ pounds of side meat per capita.

production of meat, omitting horse and goat meat, of 85.7 pounds per capita among the Central Powers. The Department of Agriculture gives the average German consumption as 113 pounds, and the average Austria-Hungarian consumption as 64 pounds. It is probable that Bulgarian and Turkish consumption approximates that of the Russian, which is 50 pounds.

WE ARE EATING LESS MEAT

In the past few years the United States has shown a tendency to reduce the volume of meat it consumes per capita. The high cost of butchers' meats has forced Americans to find substitutes, and it is not improbable that in the course of another generation meat eating in this country will fall far below the mark it has hitherto held.

Not only has our home consumption of meat fallen off, but our exports of animal products have declined immensely in ten years. If it were not for our enormous exports of lard, we would be in danger of having our foreign meat trade become a negligible quantity.

But in spite of the slowing up of per capita home consumption and of our declining meat export trade, the meat-packing industry today still takes first rank among all the manufacturing industries of the United States in the value of its products. Under the 1910 census the products of the meat-packing industry were valued at $1,370,000,000, as compared with $1,228,000,000 for foundry and machine-shop products, their closest rival (see pages 18 and 20).

More than 100,000 people are engaged in the slaughtering and meat-packing industry. During a recent year the on-the-hoof production of meats on the American farm was: 8,265,000,000 pounds of beef, 409,000,000 pounds of veal, 987,000,000 pounds of mutton and lamb, and 6,856,000,000 pounds of pork.

THE IMPORTANCE OF LARD

Lard is one of the principal items of animal products exported from the United States today. Our total production of this commodity annually amounts to approximately 1,500,000,000 pounds, of which more than 500,000,000 pounds go to other countries. Germany heretofore has taken the bulk of the lard we have exported, and the cutting off of this supply has been one of the hardships the Central Powers have had to face (see pages 21 and 22).

We use more than 10 pounds per capita in the United States, and it is generally believed that the German demand for this product is larger per capita than our own. If the 41,000,000 hogs slaughtered within the confines of the Central Powers annually produce as much lard per animal as ours, the per capita supply of the Central Powers will approximate a little less than 8 pounds.

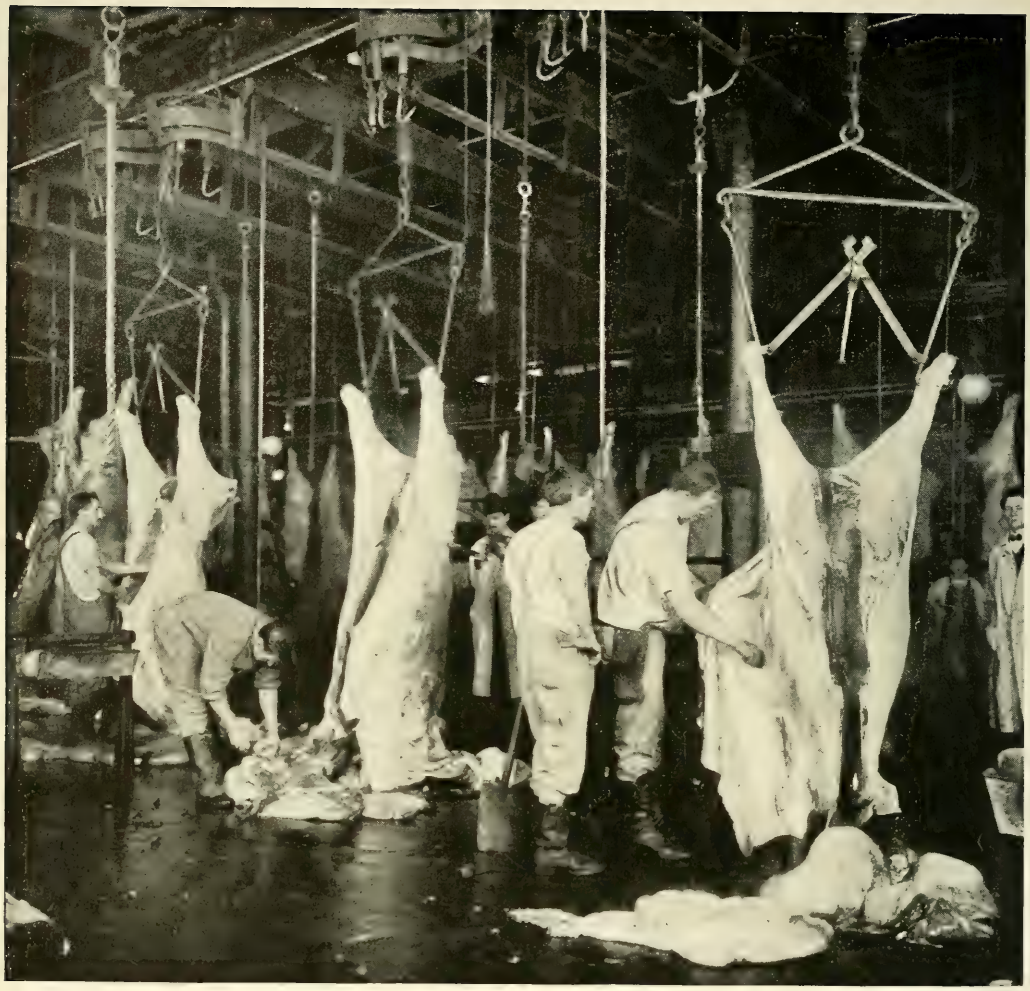
While many substitutes for lard have been found, among them cotton-seed oil and olive oil, there is no prospect that the world will ever be able to do without a very large supply of this product of the hog. The necessity of some fat or oil in the human diet is borne witness to no less by the experts in dietetics than by the universality of the use of fats and oils in cooking throughout the world.

One cannot go far enough afield—even in the remotest corners of the earth—to get beyond the reign of vegetable oils and animal fats in the human dietary. Fats are the greatest of all of the heat and energy producers with which nature provides mankind. The man fed on a diet from which all fats and oils are excluded very soon has serious disturbances of his digestive processes.

THE EVOLUTION OF THE PACKING-HOUSE

The meat-packing business is the development of the present generation. Where once there were slaughter-houses in every community, and the business of slaughtering live stock for food was widely scattered, today the industry is narrowly concentrated, and a half dozen packing towns do perhaps three-fourths of all of the butchering business of the country.

When Gustavus Swift first conceived the idea of doing the butchering near the centers of animal production and shipping the dressed meat to the centers of consumption, he saved to the American consumer one of the heaviest freight bills



Photograph from U. S. Department of Agriculture

INSPECTING VISCERA OF CATTLE CARCASSES

the nation was paying. Not only did he save the difference between the live weight of the stock slaughtered and the dressed weight, but he was able to put more tons of dressed beef into a car than he could of cattle.

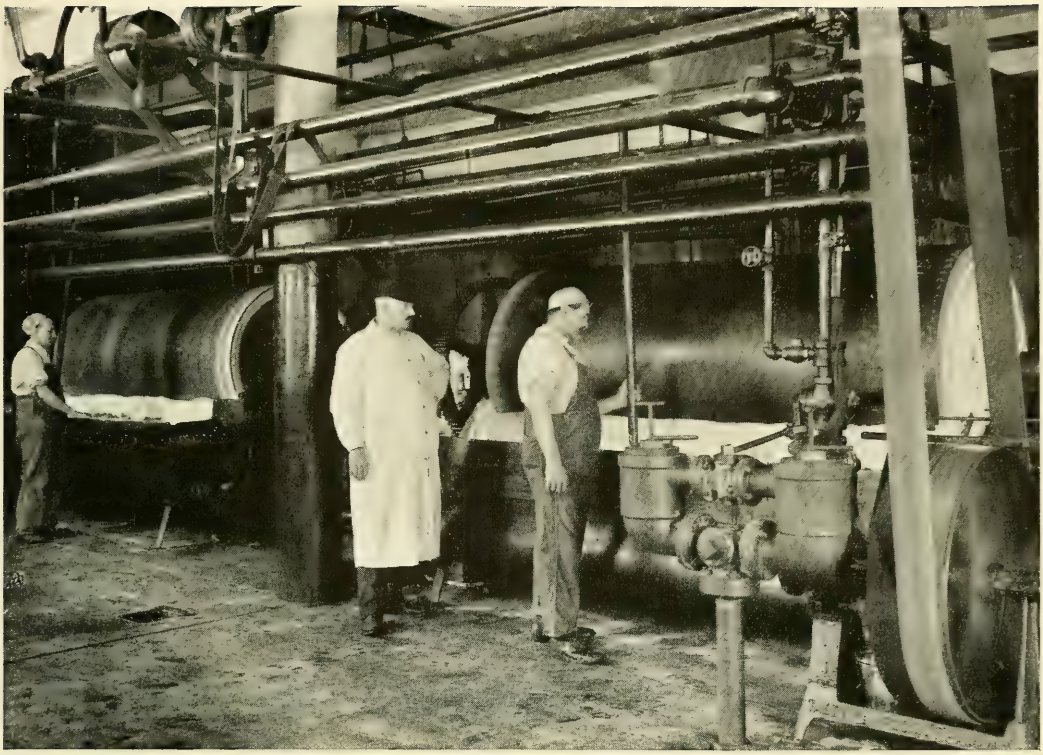
The packing business was first built up on the saving in freight. Later the use of the ordinary wastages of the slaughtering business in the manufacture of by-products effected other savings as remarkable as those on freight.

PRICE DISPARITIES

The question of the disproportion between the prices of cattle on the hoof and those of roasts and steaks is by no means a new one. Away back in 1858 people were asking how it happened that roasts and steaks were selling at 15½ cents when cattle on the hoof were bringing less than 7 cents.

It seems strange in these days to think of buying best rib roasts and porterhouse steaks at 15½ cents a pound, and yet in that year the American Agriculturist took a heavy steer through the market from the slaughter-house to the retail customer, tracing the profits derived therefrom, and found that it could be done and still leave a profit of more than five dollars per carcass to the butcher.

In those days, before the packing-town idea was evolved, there was a margin of nearly 5 cents between the price of beef on the hoof and the dressed carcass;



Photograph from U. S. Department of Agriculture

RENDERING LARD IN A CHICAGO PACKING-HOUSE

Ask your cook what dishes she would be able to prepare for you if she had no lard, butter, nor oil!

under the economies that have been effected through the packing-house idea the margin is approximately only half as much. What the prices for our steaks and roasts would be if the margin of price between meat on the hoof and meat in cold storage were as great as it used to be, one can only surmise!

THE RISE OF REFRIGERATION

How one step in the progress of catering to the world's food demands makes another possible is nowhere better shown than in the case of the packing industry. When that humble citizen of Florida, John Gorrie, invented the ice-making machine, he not only enabled the whole world to know the delights of a plentiful supply of cold water, but he also made it possible to exchange its perishable products, so that the tropics might give to the temperate zone their fruits, and the temperate zone might send to the tropics their excellent corn-fed meats and other cold-storage foods.

Once there were entire nations where only the favored few ever knew the refreshing experience of a cold drink, and it always happened that these nations were situated in those regions where a cold drink means most to humanity. The ice factory, which has meant so much to us in its relation to our own food supply, has brought the delights of ice-cream and soda water to those hundreds of millions of people who live between Capricorn and Cancer, the while it has given them Chicago, Omaha, Kansas City, and St. Joseph meats.

Cold storage is destined to play an increasingly important part in the handling of the world's food supply as the years go by and the demands for food increase. It is less than four decades since the first cargo of beef chilled by machinery instead of by ice was shipped, but today the funnels of refrigerator ships trace their lines of smoke upon every horizon.

Any one who has lived on a farm and has seen the amount of wastage there is

Photograph from U. S. Department of Agriculture

FILLING TUBS WITH PURE LARD

There are a number of grades of lard. Leaf lard is made of the fat surrounding the intestines and kidneys. Other grades are made from other fats, being reduced to a liquid grease by steam heat and then drawn off into tubs, as shown in the picture.

in the vegetable garden and the truck patch by reason of a lack of facilities for taking care of the surplus, will readily understand what a saving there could be if a cold-storage plant were convenient. Gradually these plants are coming closer and closer to the farmer, many of whom already are making use of them to store their perishable products, like fruits, vegetables, and eggs, until the higher prices of the winter months set in.

THE FISH SUPPLY

As the world fills up with people, the more humanity is bound to look to the sea for food, and a rich field will there be found. Already the United States has a fisheries industry the value of whose product nearly offsets the value of the product of its wonderful apple orchards. Our fisheries yield a return of $70,000,000 a year, which almost exactly duplicates the returns the United Kingdom receives from her fishing industry. France's annual catch reaches a value of $33,000,000, while that of Russia amounts to $50,000,000. Austria-Hungary and Germany together have a total catch of only $12,000,000 value (see pages 26-27).

It has been conservatively estimated that the world's fish supply exceeds twenty billion pounds. Japan's fisheries produce about six billion pounds a year. What our western grazing lands have been to our meat supply, that has the sea been to Japan's.

A census of the sea would reveal more animal life to the square mile, perhaps, than the land itself possesses. There are all sorts and shapes and varieties of aquatic life to be found, and the rich treasures of food which the rivers of the earth carry down to the oceans defy measure.

Gradually new fishing grounds are being opened up and new varieties of fish introduced to the public. Just now the efforts of the United States Bureau of Fisheries to restore the tile-fish to the American dinner table, and its plans for a campaign of education in favor of the edibility of the dogfish, are straws which show the direction of the wind in the utilization of the vast food treasures of the sea.

CHINESE GREAT FISH EATERS

The Chinese are among the greatest fish eaters of the world, and they have accepted so many varieties in their list of edible fishes that they can have a different kind for breakfast every morning in the year. Not only are their seas filled with fish, but their rivers as well, and while no other nation has gone as far as the United States in scientific fish propagation in fresh waters, the Chinese have cared for their fish supply through a hundred generations.

All sorts of methods for catching fish have been developed by the nations of the earth. It is a far cry from the big steam trawler of the North Sea to the hook and line of the small boy on a country creek bank. But most picturesque of all the ways of fishing in the world is that resorted to by the Chinese—fishing with cormorants. The cormorants are hatched under chicken hens, and when about three months old are taught to fish.

The trainer ties a string to one of the bird's legs and drives it into the water. He then throws out some small fish which the bird promptly catches. It is taught to dive and come back at the call of a whistle. When trained, collars are put about the bird's neck, so that it cannot swallow the fish it catches. A fisherman goes out with the rail of his boat lined with string-hitched cormorants. At a given signal they dive, and the fish that can outswim them under water is as rare as a small fish in an angler's description of his catch.

THE CEREAL CROPS

That the vegetable kingdom has more to offer the world's market basket than the animal world is revealed by a comparison of the animal products and the vegetable products of the food factories of the United States—the greatest animal-food producing country on the globe.

Although a smaller portion of the vegetable products of the country passed through factory processes than of the meat products, the vegetable manufacturing processes employed, at the last census, 292,000 people and turned out a product valued at $2,237,000,000, while

the animal product factories employed 119,000 people and yielded an output valued at $1,700,000,000.

The total products of the farms of the United States that year amounted to more than all the gold mines of the world have yielded in six centuries (see page 32).

BUMPER CROPS AND PRICES

The world's normal yield of the six great cereal crops—oats, wheat, corn, rye, barley, and rice—ranges between sixteen billion and nineteen billion bushels, and statistics show that the farmer gets less ordinarily for his big crop than he receives for his small one.

Excluding rice, we find that the 1911 cereal crop amounted to 13,786,000,000 bushels. The average value per bushel, based on the average farm price for the United States on December 1, was 72.9 cents, giving a total crop value of $10,030,000,000. The crop of 1912 was the bumper crop of the world's history, reaching a total of 16,115,000,000 bushels. The average farm price on December 1, 1912, in the United States, was 54.7 cents per bushel, showing a world crop value of $9,814,000,000.

In other words, the farmers of the world handled 2,329,000,000 bushels more of grain in 1912 than in 1911, and yet they got $1,216,000,000 less for the big crop than for the small one.

The same condition is shown in a comparison of the statistics for 1906 and 1907. Although the world's farmers produced three-quarters of a billion bushels of grain less in the latter year than in the former, they received nearly two billion dollars less for the large crop of 1906 than for the small one of 1907.

THE WORLD'S WHEAT CROP

Though man shall not live by bread alone, western civilization would find it very difficult to get along without wheat and its products. Although the wheat plant is not of western origin, it has become mainly a western product, marching hand in hand with western civilization. The world's total production of wheat approximates 4,000,000,000 bushels a year. It would take 4,000,000 of the largest freight cars, making a train reaching more than one and one-half times around the earth, to move this great annual yield. Moving at twenty miles an hour, this train would take thirty-odd days to pass a given point.

The wheat crop of the United States is approximately one-fifth of that of the entire world. It would seem that with the development of the northwestern part of this country, wheat had at last reached its limit of cultivation on American soil; but those who have studied the question most closely tell us that the wheat-growing industry has heretofore simply followed the lines of least resistance, picking out here and there the lands best suited for wheat growing; and that since all the choicest land has been opened up, the wheat growers will gradually drift back and take up the less available lands that they passed over in looking for the best (see page 34).

Not only will the trend of the wheat field be east and south, but it is certain to reach farther and farther into what is now the semi-arid regions of the West. Between its extension into the desert through irrigation and its advance into the semi-desert through the introduction of hardy, drought-resisting varieties, America is afar off from the time when the potential acreage and yield of her wheat fields is reached.

It is estimated that it will be easily possible for the United States to double its wheat-growing area. That would give us an average which, when we approximate western European standards in wheat growing, will yield very nearly as much wheat as the whole world produces today.

It has been strikingly said that he who can add a grain of wheat to each head in the world's wheat fields can give bread to millions of people, and when the United States extends her acreage to its maximum and develops the yield to its limit, nations yet unborn can rise up and secure bread from her flour bins.

RUSSIA'S WHEAT FIELDS

But as full of possibilities as the wheat-growing industry of the United States may be, they are few in comparison with

Photograph by Curtis & Miller

A FAIR "FISHERMAN": WASHINGTON STATE

"As the world fills up with people, the more it is bound to look to the sea for food, and a rich field will there be found" (see text, page 23)

those of Russia. That wonderful country, possessing more latent agricultural resources, perhaps, than any like area in the world, has 288,000,000 acres of excellent wheat land. Even at our present standard of production, which is less than half of that of western Europe, Russia alone could produce more wheat than is raised on the entire globe today.

As matters now stand, the Russian crop is only about ten bushels per acre. That her lands are as fertile and her climate as well suited to the growing of wheat as those of England and Germany are facts well known to all those who have considered her relation to the world's future food problems. Even today, in spite of her small per-acre production of every principal crop, Russia is the greatest exporter of grain in the world.

We ordinarily think of the exportation and importation of food products as being one of the most important considerations in relation to production. The world's prices for these commodities are

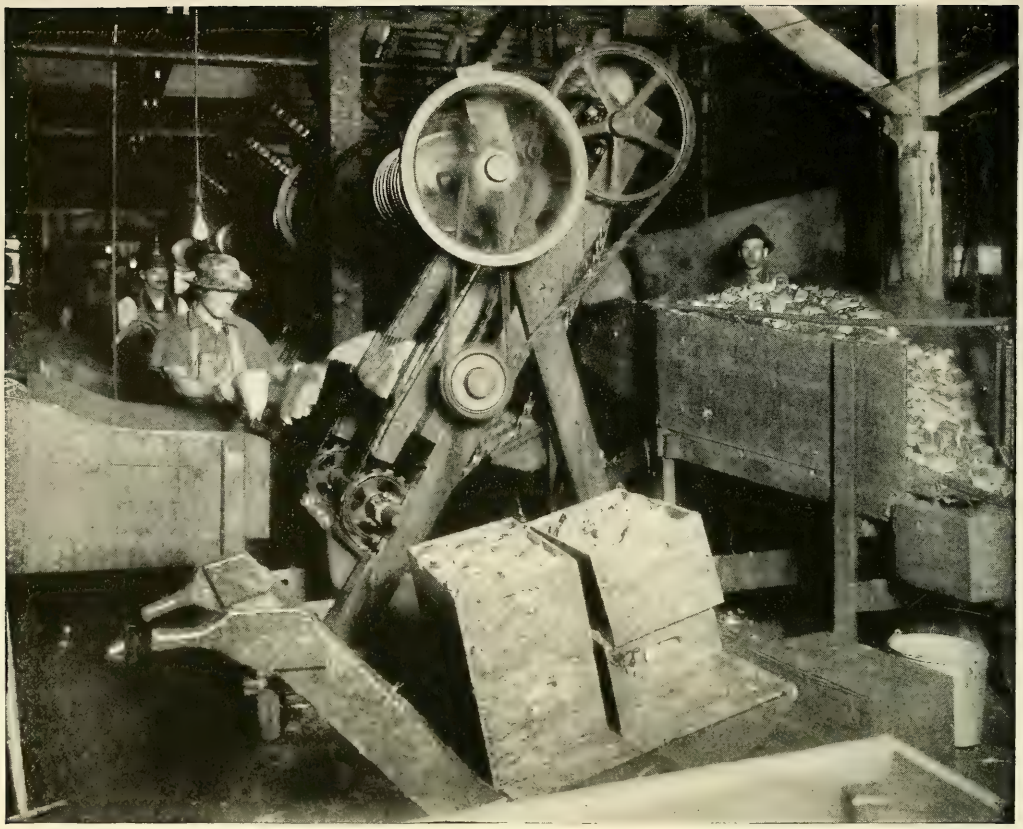
Photograph by Curtis & Miller

FROZEN HALIBUT: WASHINGTON STATE

Japan is showing the world how it is possible to get along with a very small butchers' meat supply. Its annual fish catch is rated at six billion pounds, which represents a greater weight than the dressed weight of all our beef, veal, mutton, and lamb. The Japanese virtually have come to look to the sea for their meat supply.

Photograph by Curtis & Miller

A WAREHOUSE FULL OF SALMON READY TO CAN



Photograph by Curtis & Miller

CUTTING SALMON FOR THE CANS

The salmon are fed into the "iron chink," which automatically removes the head, fins, and viscera; after that it goes to the cutting machine, which prepares it for the can

fixed by the prices received for that portion of the product moving in international trade. And yet it is quite a good bit a case of the tail wagging the dog, as will be seen from the figures in relation to wheat. Out of 4,000,000,000 bushels of wheat raised in the world, only 600,000,000 get out into the channels of international trade.

THE ORIGIN OF WHEAT

The growing of wheat has so long been a principal occupation with man that its geographical origin is unknown. The Egyptians claim it originated with Isis, while the Chinese claim to have received the seed direct as a gift from heaven. The belief that it originated in the valleys of the Euphrates and the Tigris is more generally accepted than any other. The most ancient languages mention wheat, and it has been found by the archeologists in the kitchens of the prehistoric inhabitants of the Swiss Lake region. It is generally agreed that at the lowest estimate, wheat has been a faithful servant of mankind for six thousand years.

A glance at the statistics of bread consumption shows that as meat consumption goes down that of bread rises up. The people of the United States consume 295 pounds per capita of wheat and rye per year, those of England 356 pounds, those of Germany 525 pounds, and those of France 550 pounds, which is in every case in inverse ratio to their consumption of meat.

According to available statistics, the Central Powers of Europe produced 501,000,000 bushels of wheat in 1913. This would give them a per capita production of 215 pounds. Their total production of rye amounted in the same year to 654,000,000 bushels, or 261 pounds per capita.

Photograph by Curtis & Miller

FILLING CANS BY MACHINERY

Twenty million cases of canned salmon are filled annually in Alaska

It will be seen from this that the per capita production of wheat and rye in the Central Powers is about 467 pounds, while Germany's consumption is placed at 525 pounds in normal times. It is probable that the per capita consumption is even greater in Austria-Hungary, Bulgaria, and Turkey than in Germany.

CORN AS HUMAN FOOD

While a thorough appreciation of hoecake and corn-pone is largely limited to our own Dixie, and while corn is mainly a stock food, still it occupies no inconspicuous place in the world's market basket, as any one who takes the time to examine consumption figures will find. The grist mills of the United States in 1909 produced 27,000,000 bushels of cornmeal and corn flour, and 837,000,000 pounds of hominy and grits, while the canning factories canned 168,000,000 cans of corn.

It is said that Mexico's production of corn is worth more, in normal times, than her production of gold, and although the Mexican mines are world famous for the prodigality of their yield, any one who has seen at first-hand the universal sway of the tortilla can well believe that the Mexican cornfield outranks the Mexican gold mine.

Today the United States produces two-thirds of the world's supply of corn. It devotes a little more than twice as much acreage to that crop as it does to wheat. Our average yield is 23.1 bushels to the acre (see page 32).

There is no place better suited to demonstrate the possibilities of scientific agriculture than in the handling of the nation's corn crop. If we were to take the average yields of all the boys' corn-growing clubs of the United States, we would probably find them ranging around eighty bushels to the acre. This would give a total yield, on the basis of the present

Photograph from U. S. Department of Agriculture

BEEF BALED LIKE HAY OR COTTON

All edible scrap meat in the packing-house is baled together and packed away in a freezing room to await conversion into potted beef and other similar products. Note the ice on the pipes.

acreage under cultivation in the United States, two and one-third times as large as that of the entire world today (see pages 101 and 105).

It is certainly not unreasonable to believe that the average farmer of the United States in future years will do as well as the average boy of the corn club today. When we remember that the youthful enthusiasts of the corn clubs of today will be the farmers of tomorrow, it probably is not too much to hope that the time is less than a generation distant when the United States can add billions of bushels of corn to the needs of a growing race.

It is fitting that the Americas should produce approximately three-fourths of the world's corn, for corn is a true American. It was here when Columbus came to the New World, and the early colonists left a record of the fact that they learned the lesson of its use from the red men.

BARLEY AND RYE

We who have spent all of our lives in the United States have little realization of the important part barley and rye play in the market baskets of many countries, for beyond a little barley broth and an occasional loaf of rye bread, the American does not often meet these cereals at meal time. Yet in Russia, in southeastern Europe, and in parts of Asia barley and rye meal are the raw material of the

bread of the masses. The barley and rye crops of the earth together would fill more than two million freight cars, enough to more than belt the earth at the Equator.

In Japan, when the people get too poor to eat rice they resort to barley, and it is said that there is a social distinction drawn between the rice-eating and the barley-eating natives. Barley formerly was more frequently used in western Europe than it is today; it was the cereal from which the goose pie was made in the early days of England.

In bulk, oats is the greatest of all the cereal crops of the world, though in weight it is surpassed by several others. It was Doctor Johnson, I believe, who said that they fed oats to horses in England and to men in Scotland. The retort was that Scotland was famous for its men and England for its horses. Though oats figure mainly in the world's diet as a breakfast food, still the total used as human food is an important one.

Photograph by A. W. Cutler

"TWO'S COMPANY": INCIDENTALLY A WHEAT-FIELD COURTSHIP

ASIA THE HOME OF RICE

Although the United States produces more than 700,000,000 pounds of rice, this is but a drop in the bucket as compared with the production of Asia. That continent, although making a remarkably poor showing in its production of live stock and those cereals which we most extensively grow, has almost a monopoly of the production of rice. Out of the total world's production of 162,000,000,000 pounds, it grows 159,000,000,000. Perhaps nine-tenths of all the rice eaten in the world is eaten by the Asiatics. To the great masses of Asia's unnumbered millions it is largely both bread and meat (see page 38).

The rice crop must be grown in water, the fields being kept flooded the greater part of the time until it matures. This necessitates a system of canals or other means of irrigation. In many parts of China and Japan the coolie laborers are always kept busy pumping water for the rice fields. In some cases they raise the water by hand from one level to another by buckets; in others, primitive water-wheels are equipped with treading-boards, so that the men can turn the wheels with their feet; still other wheels are turned by animal power (see page 39).

In the Philippines, Java, and parts of southern Asia thousands of water buffaloes are used to drag the plows and harrows through the mud in preparing the seed bed for the crop. In the chief rice-raising countries the harvest time is an important event. At the beginning the natives often have picnics; in Java, they erect little temples, about the size of a pigeon-house, containing an offering of

Photograph from U. S. Department of Agriculture

A TWENTIETH CENTURY CORNFIELD

"There is no place better suited to demonstrate the possibilities of scientific agriculture than in the handling of the nation's corn crop. If we were to take the average yield of all the boys' corn-growing clubs of the United States, we would probably find it ranging around eighty bushels to the acre. This would give a total yield, on the basis of the present acreage under cultivation in the United States, two and one-third times as large as that of the entire world today" (see text, page 29).

Photograph from A. W. Thompson

CORN RAISED BY A FARMER OF PRESTON, MINNESOTA

With such agriculture as this the United States and Russia alone could feed the whole world as it is populated today

Photograph by Webster & Stevens

A WHEAT FIELD IN EASTERN WASHINGTON

"It has been strikingly said that he who can add a grain of wheat to each head in the world's wheat fields can give bread to millions of people, and when the United States extends her acreage to its maximum and develops the yield to the limit, nations yet unborn can rise up and secure bread from her flour bins" (see text, page 24).

Photograph and copyright by Keystone View Co.

BONANZA FARMING IN THE NORTHWEST

This machine cuts, threshes, bags, and weighs the wheat in a single operation. The teamster who can handle the fifteen to thirty horses required to operate it commands good wages.

an egg, some fruit, a bit of sugar-cane, and some cooked rice.

The husks of rice stick so tightly to the grain that the latter is left rough when the husk is removed. The grains are thrown upon rollers covered with sheepskin and polished just as we might polish silver or gold. Medical science has learned that the absence of the elements contained in the rice husk produces the disease known as beriberi when an exclusive rice diet is eaten, just as a too exclusive diet of corn produces pellagra.

These two discoveries open up an entirely new field in the investigation of the causation of little understood diseases. They rank with the discovery of the method of transmitting malaria, yellow fever, bubonic plague, and sleeping sickness by mosquitoes, fleas, and tsetse flies, respectively.

THE PLACE OF THE POTATO

It has been the honor of America to contribute to the world its greatest crop in point of yield — the white potato. Making its bow to civilization from the land of the Incas, in Peru, the potato has girdled the globe, winning the esteem of every land and every people.

No other plant in the entire range of the vegetable kingdom has ever gone so far or met with such universal favor in so short a time as this apple of the earth. Today North America produces more than half a billion bushels, while Europe produces approximately ten times as much as our own continent, and has practically a monopoly of the potato-growing industry, producing nine out of every ten bushels grown in the world (see p. 106).

A NEW BEAST OF BURDEN

Figuring to such a large extent in the diet of the race, the potato offers a solution of one of the important problems that the farmers of the earth are facing. There are more than one hundred million horses in the world, most of them being found on the farm. To provide these horses with grain and hay and pasturage requires several hundred million acres of the world's best land.

It so happens that the potato is an admirable material out of which to make alcohol for motive power. Under modern methods of distillation, a few acres of potatoes can be made to yield enough alcohol to drive the farm-tractors of an ordinary farm. The average farmer has held to the horse as a means of transportation because he could use him without

WINNOWING WHEAT IN PERSIA

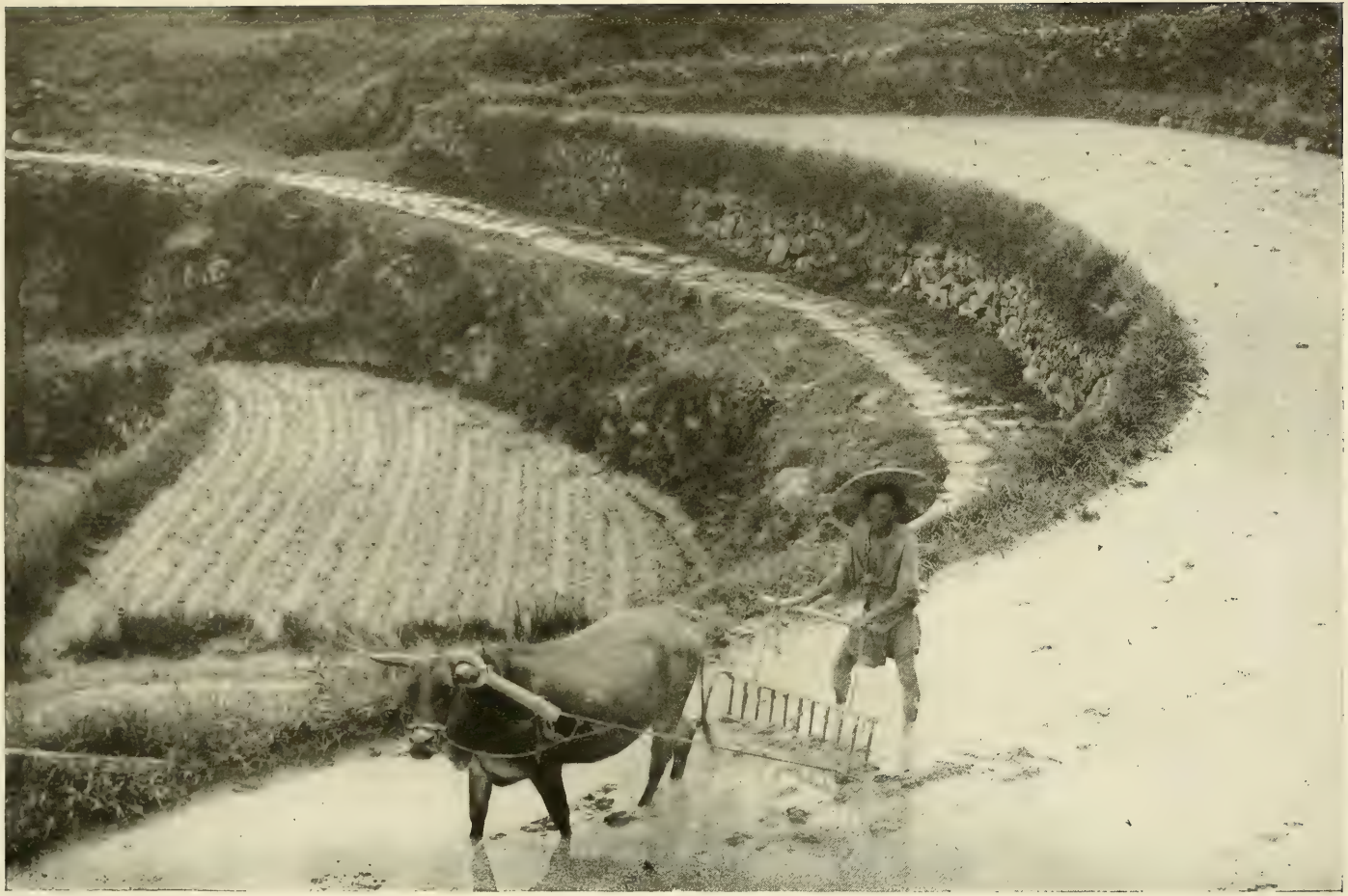
Photograph by Alfred H. Heinicke

A comparison of this picture with those on pages 35 and 37 shows how man has multiplied his productive capacity many times since the advent of farming with machinery

Photograph from U. S. Department of Agriculture

THRESHING TIME IN THE WHEAT BELT

"That wonderful country (Russia), possessing more latent agricultural resources, perhaps, than any like area in the world, has 288,000,000 acres of excellent wheat land. Even at our standard of production, which is less than half of that of western Europe, Russia alone could produce more wheat than is raised on the entire globe today. As matters now stand, the Russian crop is about ten bushels per acre" (see text, page 25).



CULTIVATING RICE IN ASIA

"Could we, like Maupassant, turn loose our fancy as we dine, we could see a great army of men and women working that we might eat. The appetites of men now levy tribute upon all the continents and all the seas, and, where once all roads led to Rome, now they come directly to our dinner tables" (see text, page 104).

SOWING RICE BROADCAST: SIAM

Medical science has learned that the absence of the elements contained in the rice husks produces the disease known as beri beri when an exclusive polished rice diet is eaten, just as a too exclusive diet of corn produces pellagra

TRANSPLANTING RICE IN AN INUNDATED SOIL: JAPAN

Rice yields best in lowlands subject to occasional inundations. In some districts it is sown broadcast (see page 39) and in some districts is transplanted after two or three weeks. The best rice soil is often not well suited for any other crop. Asia produces 99 out of every 100 pounds of the world's rice.

Photograph and copyright by the International Press Photo Co.

CHINESE EGGS WELL RIPENED

The ancient egg in China has as much standing in good society as wine of rare old vintage in Europe, there being no accounting for taste

Photograph and copyright by the International Press Photo Co.

CHINESE EDIBLE BIRDS' NESTS ARE WORTH THIRTY DOLLARS A POUND

Photograph from F. J. Koch

BRINGING IN THE POTATO CROP: NEAR NAIROBI, EAST AFRICA

"It has been the honor of America to contribute to the world the greatest crop in point of yield—the white potato. Making its bow to civilization from the land of the Incas, in Peru, the potato has girdled the globe, winning the esteem of every land and every people. No other plant in the entire range of the vegetable kingdom has ever gone so far or met with such favor in so short a time as this apple of the earth" (see text, page 35).

Photograph by Curtis & Miller

HOLSTEIN-FRIESIANS ON A MODERN DAIRY FARM

The cows of the United States give between six and seven billion gallons of milk a year. In other words, we use upward of five gallons per month per capita. The average American eats about seventeen pounds of butter annually.

Photograph from U. S. Department of Agriculture

CHURNING BUTTER IN A COÖPERATIVE CREAMERY

The twentieth century rural housewife is exchanging the old-time skimming ladle for a modern cream separator, and in doing so is taking another step toward her emancipation from the drudgery and grind of farm life

Photograph and copyright by Underwood & Underwood

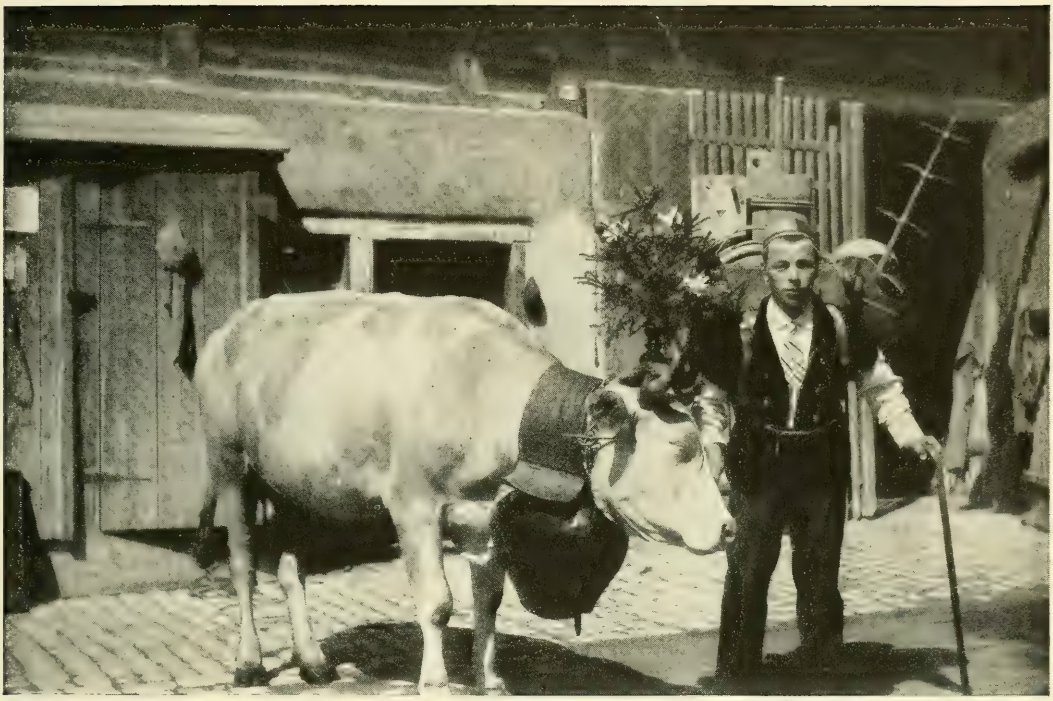
PACKING BUTTER IN TUBS FOR CITY MARKETS

There is probably no other commodity in the American market basket that needs regulation today more than butter. The butterfat furnished to creameries comes from nearly half a million farms, and a given pound of butter may contain butterfat from a score or more of farmers' dairies. The tuberculosis germ finds butter a fine vehicle in which to travel long distances in quest of some run-down system to attack.

Photograph by Gilbert H. Grosvenor

MILKMAID IN STOCKHOLM, SWEDEN

The "milkman" comes afoot in Sweden, in a dog-cart in Belgium, on the hoof in parts of Spain and South America, with a spick and span team and in a uniform in Washington



Photograph by Alix Bodenheimer

THE LEADING COW, WITH ANTIQUE BELL, LEAVING FOR THE ALPS IN SPRING

The cowbells, which are worn by all cattle while pasturing in the Alps, assist the cowherds in preventing the cattle from straying. These cowherds form a distinct class, who do not own the cattle they tend. The milk given each day is entered in a book, and then made into butter or cheese, the cowherds and the cheesemaker having a right to a certain proportion of the milk for their own use. At the end of the season the proceeds from each cow is turned over to the owner, and the herder receives a share, together with a small sum for each cow tended.

making any actual outlay of cash for his keep.

A very much smaller acreage and a very much smaller investment of labor would provide the necessary alcohol for a tractor-operated farm than would be required to feed the horses the tractors would substitute. Many advanced farmers in various parts of the world have substituted the horse with potato-alcohol-driven motors, and with remarkably successful results. It would be one of the most revolutionary developments of human history if the humble potato should become at once both team and food. The world's present potato crop is approximately large enough to fill two-thirds of the Panama Canal.

MILK A UNIVERSAL COMMODITY

In any discussion of the world's market basket the importance of milk cannot be overlooked. In the United States alone we produce more than six billion gallons a year. This is an average of nearly one gallon per cow a day. Exclusive of the milk and cream consumed on the farms of the country (which, by the way, represents the bulk of our production), our dairy products are worth $600,000,000 a year (see page 44).

In other words, they are worth enough to build a Panama Canal and pay for the maintenance of the American army and navy every year.

Only one-third of all of the milk produced in the United States is sold from the farm. Much of that which remains is used for domestic purposes there, although a billion pounds of butter is proudly exhibited by the American farm as one of its by-products.

The total production of butter in the United States is around 1,700,000,000

THE MILK PEDDLER: CARACAS, VENEZUELA

pounds. While ten out of every seventeen pounds of our butter is produced on the farm, nearly all of our cheese is made in factories (see page 67).

MILK FROM MANY ANIMALS USED

Milk is used everywhere that man lives, and it is secured from many different kinds of animals. Around the Arctic Ocean the Laplander milks his reindeer and freezes the milk into blocks to keep until needed; in the desert regions of Asia and Africa the natives drink the milk of camels and donkeys; in western Asia there are wandering Tatar tribes who live largely on mare's milk. In many countries the goat is the poor man's cow, while sheep milk is widely used in the manufacture of cheese in Europe.

In recent years Russia has built up a large dairy industry in Siberia, and before the war great express trains, sweeping across two continents, carrying nothing but dairy products, were a striking object-lesson of the world's craving for butter and cheese. The Chinese, Koreans, and Japanese use comparatively little milk, their countries being too populous to admit of the keeping of many cows.

BUTTER AND CHEESE TRADE

Little Denmark leads all the countries of the world in the exportation of dairy products, and Danish butter is known wherever good living is enjoyed. Danish dairymen have been imported to all parts of the temperate world to teach the secrets of high-class dairying (see page 45).

The volume of butter which in normal times reaches the channels of international trade amounts to 728,000,000 pounds, which is less than half of the butter production of the United States alone. The per capita consumption of butter in the United States is about 17 pounds. On the same basis, Germany would consume 1,139,000,000 pounds. In 1913 that country imported 122,000,000 pounds more than it exported.

It will be seen from this that if she normally uses as much butter as we do, her shortage would be 10.7 per cent. However, Norway, Sweden, Denmark, and Holland have about 326,000,000

Photograph from U. S. Dept. of Agriculture

THE FATHER OF A GOOD FARMER

As the child is father to the man, so the youthful member of a boys' corn club is the father of a farmer who will help to solve the food problems of future generations.

Photograph from U. S. Dept. of Agriculture

A MODERN MILKMAID

Twentieth century science is fast emancipating the American farmer's family from the burdens of the past. This young woman from Tennessee so distinguished herself as to win two State championships in women's farm work, and she is today on the payroll of Uncle Sam as an evangelist of the new Emancipation.

Photograph by A. W. Cutler

SELF-INVITED GUESTS AT A STAND-UP LUNCHEON

"Pigs is pigs," but after the first few days each has his own special place at the "table."

Photograph from U. S. Dept. of Agriculture

THE GOVERNMENT'S SEAL OF APPROVAL

When the meat inspection law was enacted in 1906, it insured the people of the country that at least three-fifths of the meat they eat is the product of healthy animals slaughtered under proper conditions. There is an inspection of the live animals, and another of their viscera, as well as of the meat itself. Even the railroads are forbidden, under heavy penalty, to ship any meat in interstate commerce that does not have the seal of the Government's approval thereon. There is no Government inspection of meat consumed within the state of origin, or of that slaughtered by retail butchers or on the farm.

Photograph from U. S. Forest Service

A WESTERN FLOCK RESTING BENEATH THE TREES IN A NATIONAL FOREST RESERVE

Archeological research points to the fact that the sheep probably was the first food-animal domesticated by man.

Photograph from U. S. Forest Service

THE TWENTIETH CENTURY SHEPHERD AND HIS FLOCK

Nowhere does the intelligence of a dog appear to better advantage than when acting as chief assistant to a shepherd. They seem to read the minds of their charges, and instinctively to meet every emergency that arises out of that strange combination of natural timidity and follow-your-leader spirit which characterizes the sheep.

Photograph from U. S. Forest Service

COMING DOWN TO THE WATER HOLE

There are more sheep in the world than any other kind of domesticated quadruped. There are only one-sixth as many horses, and one-fourth as many hogs. There are 631,000,000 sheep as compared with 434,000,000 cattle.

Photograph from U. S. Forest Service

"FIVE, SIX, SEVEN"

Sheep Herder and Forest Ranger jointly counting a flock that is to be turned out to graze on the public domain at so much per head. Last year 7,232,000 sheep were pastured on the succulent grass which grows on the lands dedicated to the National forests.

Photograph by Curtis & Miller

A PROFITABLE HAUL

Europe's expanding population forced her to face a meat shortage before America was born into the family of nations. She turned to the sea and it responded with low-priced fish as a substitute for high-priced beef and pork.

Photograph by Putnam & Valentine

CALIFORNIA SALT BEDS

The world's annual production of salt approximates thirty billion pounds, of which the United States of America produces nearly one-fourth. It is said that the earliest trade routes of the world were established for the transportation of salt and incense, the two great articles of international commerce in the ancient world.

Photograph by Curtis & Miller

A PEACH AMONG PEACHES—WASHINGTON STATE

Photograph by Brown Bros.

IN THE EMBRACE OF WINTER

Is there anything more beautiful than a laughing, sparkling stream, snow-lined to its brink, and yet so busy in its onward rush to the sea that the encroaching ice dare not bridge its depths?

Photograph by Brown Bros.

A SNOW-BOUND LOVERS' LANE

Photograph by Brown Bros.

A UNIVERSITY CAMPUS IN JANUARY

The brisk west wind and the snappy clear cold put the stamina of endurance into man and woman.

Photograph by Brown Bros.

OFF TO A WINTER MORNING'S WORK

The hardy New England farmer is up betimes of a winter morning when Nature slumbers beneath a blanket of snow, and an overcoat would be useless baggage to him as he fares forth to his labors.

Photograph by Brown Bros.

THE LITTLE RED SCHOOLHOUSE

Although the little red schoolhouse and the three R's that were taught within its walls are largely giving place to the consolidated rural school and the redirected rural curriculum, it is still enshrined in the hearts of many millions of sturdy Americans who received their early education there.

pounds to export annually, while Austria-Hungary has a surplus of 4,000,000 pounds. In normal times England takes three-fifths of the world's surplus of butter; in 1912, out of 728,000,000 pounds moving in international commerce, the United Kingdom took 435,000,000 pounds.

There are no world statistics of the production of cheese, except of that part moving in international trade. The United States annually produces about four pounds per capita. The total amount imported by all the countries of the world is 531,000,000 pounds, of which the United Kingdom takes 250,000,000, Germany 47,000,000, and Austria-Hungary 13,000,000 pounds. Bulgaria exports 7,500,000 pounds, and Holland and Switzerland have 190,000,000 pounds to give a cheese-hungry world.

VEGETABLES AND FRUITS

The Department of Agriculture estimates that one-fourth of our country's diet consists of vegetables—products of the truck garden. If this is true of the United States, which, next to Australia, is the world's largest per capita meat-eater, it is more true of other countries. Our census returns show that we produce, exclusive of potatoes and sweet potatoes, vegetables to a value of $216,000,000.

The tomato takes first rank, with a $14,000,000 production to its credit; the onion contributes exactly one-half as much to the total as the tomato, while sweet corn makes a successful bid for third place; watermelons get fourth place, with a production valued at $5,000,000, and cantaloupes add $4,000,000 more to the total. Green beans and green peas are $3,000,000 crops. These figures deal almost entirely with the production that gets to the city market and not with the vegetables raised for consumption on the farm (see pages 4 and 107).

THE KITCHEN GARDEN

There is probably no farm-house in all the land so poor as to be without its vegetable garden and its truck patch, and between the dried beans, corn, peas, etc., and the canned cucumbers, beets, tomatoes, ketchup, and what not, the rural housewife takes her family into the winter with the assurance that, high cost of living or no high cost of living, there will be no dearth of vegetables on her table.

If the products of the vegetable garden figure extensively in the world's diet, they play no greater rôle than the products of the orchard, vineyard, and berry patch. The total yield of the latter, according to the last census, is worth $222,000,000 a year.

Orchard fruits are produced to an annual value of $140,000,000. We produce a bushel and a half of apples per capita, a third of a bushel of peaches, two quarts and a half of strawberries, and other things in proportion. Grape-vines and citrous trees each yield $22,000,000 worth of fruit a year, while our berry crop is valued at $29,000,000 (see page 73).

While most of our fruits and vegetables come to us in their natural state or canned, the country annually produces millions of dollars' worth of dried fruits—a production which figures more largely in other parts of the world than in our own.

THE ART OF CANNING

It is only a little more than a century since the fruit-jar came into use. Before that the only way of keeping the fruits and vegetables that are now canned was to dry them or put them away in sugar or salt. The invention of the modern process of canning is credited to Nicholas Appert, a Frenchman. His method was to put the food to be preserved in glass jars, set them in boiling water, and, when the contents were thoroughly heated, seal the jar (see also page 1).

Although Napoleon gave Appert twelve thousand francs for his work, he simply had built on foundations well laid by Spallanzani nearly a half century before. The apparatus used by Appert in his canning processes was very crude, but his discoveries laid the foundation for one of the important industries of modern times, and have proved a boon to the urban population of the earth.

While Napoleon Bonaparte paid for the discovery of the canning process, his

enemy, England, was quick to take up the discovery and to utilize it for her own purposes. About 1815 Ezra Daggert brought to the United States a process for canning salmon, lobsters, and oysters. This process was gradually extended to pickles, jellies, and sauces.

HOUSEWIVES ADOPT SCIENTIFIC DISCOVERIES

It is rather striking to pause and reflect that in a single century humanity has progressed to such an extent that the most ignorant housewife in America can now do work that formerly defied the best scientists of the world (see page 107).

Only the first centennial has passed of William Underwood's invention of a process of canning tomatoes, and it is only seventy-eight years since Isaac Winslow learned how to can corn at Portland, Maine. Today the glass jars of Appert have been succeeded, except in the household canning art, by the tin can, and many wonderful machines have been devised to save labor in the canning industry.

There are hulling machines which will take green peas out of the pods at the rate of a thousand bushels a day; there are separators which will grade the peas according to size; there are corn-cutters which remove the grain from the cob at the rate of four thousand ears an hour, and silking machines which work at equal speed; and there are automatic machines which will fill twelve thousand cans a day. If Nicholas Appert could come to life and go through a modern cannery, with its wonderful equipment, he would doubtless marvel at the mighty oak that grew from the tiny acorn of his discovery.

THE PLACE OF POULTRY

There are no statistics showing the number of domesticated fowls the world possesses, but if the United States' ratio of three per capita were the rule, there would be some five billion of them. It is probable, however, that there are not half that many.

The annual product of the American chicken yard is estimated at $509,000,000. During the last census year the American hen produced nearly twenty billion eggs, of which eleven billion were sold. It will be seen from this that the American farmer keeps a liberal supply of eggs for his own table and for hatching purposes. His receipts from the sale of eggs totaled $202,000,000 (see pages 80 and 81).

We annually raise nearly a half billion chickens in the United States. Out of 488,000,000 raised in the last census year, the farmer kept all but 153,000,000 for his own purposes, which again shows that the farmer's table is not skimped in order that his urban neighbor may eat well.

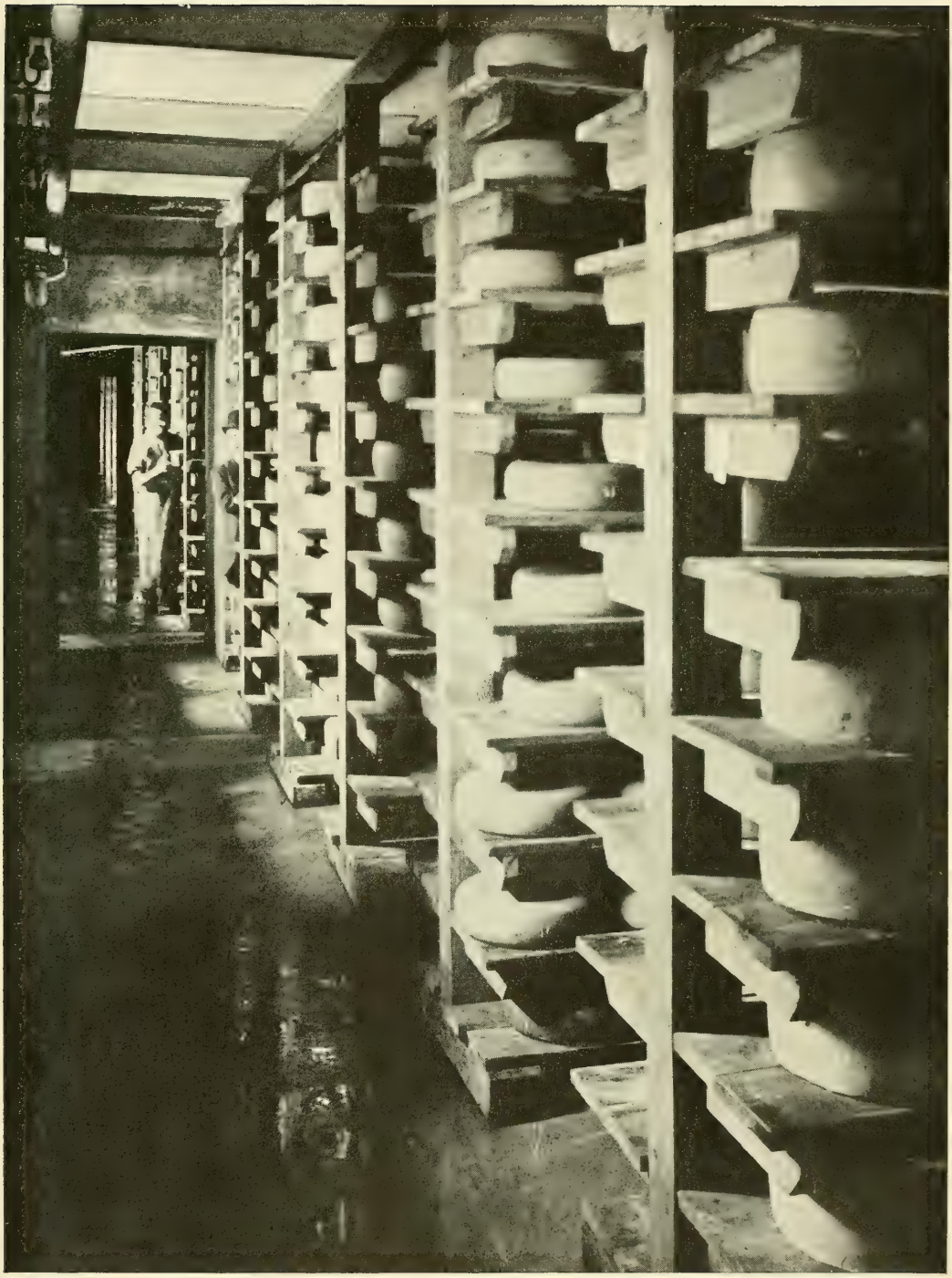
THE INDUSTRIOUS BEE

Nowhere else in the world is the majesty of small things more strikingly revealed than in the story of the production of honey in the United States. That great decennial interrogation mark which marches every ten years through the homes of the American people and asks them a thousand and one questions, has ascertained for us that the bees of the country annually produce twenty-seven thousand tons of honey. That means fifty-four million pounds.

Truly the busy little bee must improve each shining hour to give to the American people fifty-four million pounds of honey, in addition to providing for its own needs. The number of trips from hive to flower and from flower to hive with their tiny loads of honey-making materials that the bees must have taken to bring us these fifty-four million pounds of honey defies estimate, but they afford us an inspiring lesson of what the faithful doing of small things may accomplish.

THE SUGAR INDUSTRY

When one writes of honey his mind turns to sugar—a crop which occupies a very important place in the world's market basket. Humanity always has had a sweet tooth, and the day when sugar was first made from cane is so remote that history is not certain that it can fix the date. And yet in one generation the world has increased its sugar production more than nine-fold. Forty years ago it took only 2,200,000 tons to satisfy the world's sweet tooth; today it takes more than 20,300,000 tons. And still the world is hungry for sugar (see page 87).



Photograph by Underwood & Underwood

HUNDREDS OF CHEESES CURING IN THE RACKS OF AN UP-TO-DATE FACTORY

The people of the United States eat a little more than three pounds of cheese a year. The cheese-making industry has almost entirely passed from the farm to the factory.

Photograph by A. W. Cutler

ARAB WOMAN AND HER GOATSKIN CHURN

All people must have oil or fat in some form. The Eskimo likes seal blubber, the Spaniard wants his liberal allowance of olive oil. Butter from mare's milk, camel's milk, or sheep's milk is in demand among various peoples.

The American people have increased their annual per capita consumption in that time from eighteen pounds to eighty-nine pounds. The Australian Commonwealth has the sweetest tooth of all the countries of the world, its per capita consumption being 109 pounds. Denmark has second place and Canada third; the United States comes fourth.

The sugar industry is a profitable one to the grower; it was recently estimated that the value of the sugar crop to the grower is $815,000,000, while the price paid therefor by the consumer approximated $2,000,000,000.

A TRADE WITH UPS AND DOWNS

The sugar consumed in any country fluctuates quite appreciably with financial conditions. During every financial depression the per capita consumption declines, and whenever prosperity reaches high tide, sugar consumption approaches its climax. One might write the financial ups and downs of the world in terms of sugar.

The world's production of sugar is divided half and half between sugar-cane and the sugar-beet. Sugar-cane is a very ancient crop, and in many parts of the world one of the most profitable grown. The cane has a preference for the tropics, although it is able to wander as far north as the southern part of the United States.

The sugar-beet, on the other hand, loves a cooler climate, and consequently adds immensely to the world's possible sugar-producing area. While Maggraf discovered that sugar could be made from the beet many years before the Napoleonic wars, it was not until that time that his discovery was put to any large commercial use. There is no difference between the sugar derived from cane and that extracted from beets (see page 86).

A TASTE FOR CANDY

The taste of the American citizen for sweet things is emphasized by his remarkable consumption of candy. We eat a half billion dollars' worth every year, which is said to be more than half the world's total production. The candy habit is one that is not easily changed, and people are inclined to do without sweets unless they can secure their favorite kinds. The candy importers of New York find it necessary to purchase candy from the most remote regions of the world in order to satisfy the demands of immigrants who come from those regions.

The Chinese appear to have first established the art of candy making. Most interesting of their candy products are the candy oranges and the candy eggs, the former the peel of an orange filled with native candy, and the latter the shell of an egg filled in the same way. These have been manipulated in such a way that the purchaser cannot find the opening through which the original contents were ejected and the sweets inserted. To reach the contents of the orange, it is necessary to peel it, and one has to break the egg to get the candy out.

A noted physician has declared that sweetness is to the taste what beauty is to the eye and music to the ear. He says that more than one-half of all the foods in the world have a sweet or sweetish taste, while only one-third possess a salty taste and one-tenth a bitter or sour taste.

He also points out that man is not the only creature with a sweet tooth. One can win the affection of a horse quicker by feeding him sugar than in any other way, while the bear and the fox, in their ravages on the wild honey of the forest and field, probably experience a satisfaction resembling that of a hungry child who surreptitiously gets sweets from mother's cupboard.

Sugar is manufactured from raisins in practically all of the countries of southern Europe and western Asia. There are two forms of raisin sugar imported into New York, one principally from Asia Minor and the other mainly from Spain. The Turks add to the delicacy of grape sugar by the use of small quantities of rosewater.

CIVILIZATION'S COFFEE CUP

The people of the world annually consume more than two and one-half billion pounds of coffee—enough to load a train of cars reaching from Philadelphia to

Photograph by T. P. Robinson

A CELERY FARM IN MICHIGAN

Celery is a plant of recent domestication and is one of the acceptable immigrants of the vegetable kingdom which have come to our shores

Photograph by N. H. Darton

PICKING ORANGES IN CALIFORNIA

Because of the great freeze of two decades ago and the competition of the spirited Western growers, Florida has been forced to yield first place in the orange industry to California

Pittsburgh. Three-fourths of this is grown in Brazil, a country that has become rich from its coffee industry alone. Europe and North America bear approximately the same relation to the consumption of coffee that Brazil does to its production, these two continents using nearly four-fifths of all the coffee the world produces.

Holland is the greatest coffee-drinking nation on the globe. It uses 15⅛ pounds per capita annually, while we use 9½ pounds, Germany 5⅛ pounds, Austria-Hungary $2^{2}/_{5}$ pounds, and the United Kingdom ⅔ of a pound. On the other hand, we use less than one pound of tea per capita, where the United Kingdom uses nearly seven pounds. Canada is about two-thirds English and one-third American in its use of coffee and tea; it shows a decided preference for the tea, but drinks less of it than the mother country, making up the difference with coffee. The Germans and the Austro-Hungarians use only a negligible quantity of tea.

The coffee plant is a shrub which, under cultivation, grows from 4 to 6 feet high. In its wild state it grows three or four times as high as in its cultivated state. The dwarfing of the plant increases the crop and facilitates picking. The leaves are of a fresh green color; the flowers are white and have an odor strongly resembling jasmine.

The green coffee berry of commerce is nothing more nor less than the seeds of the coffee "cherry." These "cherries"

Photograph by Curtis & Miller

A BRANCH OF JONATHANS: YAKIMA VALLEY, WASHINGTON

From the days when Andrew Stevenson, American minister to the court of St. James, presented a lot of Albemarle pippins to the Queen of England, America has always produced apples fit for any queen. Our apple crop is worth several times as much as the banana crop of both the Americas.

Photograph by Curtis & Miller

TOKAY GRAPES: PACIFIC COAST FRUIT BELT

"California's supremacy as a grower of the newer crops is shown all along the line. Out of the nation's 6,793,000 pounds of almonds, that State grows 6,692,000 pounds; out of 4,150,000 bushels of apricots, it shows a production of 4,066,000 bushels; out of 35,000,000 pounds of figs for the entire country, 23,000,000 belong to her credit; out of the country's total of 2,571,000,000 pounds of grapes, California is credited with 1,979,000,000 pounds" (see text, page 79).

turn crimson on ripening. They are then picked, the pulp is taken off by machinery, and the two husks which lie between the pulp and the seeds themselves are removed. The coffee has to be thoroughly dried before the husks can be taken off, and on many plantations there are whole acres of concrete floors for this drying process.

When run through the machinery for the removal of the husks, these latter are blown away like chaff, and the coffee grains are run over sieves so arranged as to grade them and bag them according to size, ready to be shipped to the world's markets.

PRODUCTION OF TEA

The growing of tea is largely an Asiatic industry. The tea plant is a hardy evergreen shrub, growing from 12 to 15 feet high in its wild state, but dwarfed under cultivation. It prefers a subtropical climate where the rainfall approximates 50 inches a year. After the leaves are picked the tea reaches its commercial state by two routes—one producing the black variety of the tea and the other the green.

The leaves are first dried in the sun in the case of black tea, and in pans over fire in the case of green tea. In both processes the leaves are next rolled until soft. Black tea is next fermented, then fired, and finally sorted. Green tea is withered again following the rolling process, sorted into bags, and then slowly roasted.

In China most of the tea gardens are

small, each farmer producing enough for the consumption of his own family, and a little surplus which he sends to the market. The Department of Agriculture has interested itself in the production of tea in this country, and has issued a bulletin which reveals the fact that in South Carolina and elsewhere on the southern Atlantic seaboard America has proved a successful grower of this plant.

THE BANANA INDUSTRY

It is not so many years ago that the banana was a tropical crop, grown only for home consumption by residents of the river valleys of the tropical countries. It was sold mainly by street venders in the villages and towns, and only in exceptional cases did any reach American and European markets; but today we are importing more than 40,000,000 bunches of bananas into the United States every year, and the value of these importations ranges around $14,000,000.

The first bananas ever imported came in 1869, and in many parts of the country it was twenty years later before they came to stay. It has been only in recent years that the banana reached Europe. England now buys about 7,000,000 bunches a year (see page 89).

A visit to a banana plantation is an interesting experience. The banana tree wants a rich soil; but, given that, no other tree known can grow faster. In preparing a banana plantation, the jungle is first cut down, and sprouts are planted in rows about six feet apart. By the time the tree is ready to bear, every bit of the jungle debris has disappeared, except that here and there an occasional hardwood tree still lies prone upon the ground. One can scarcely believe his eyes when he sees how quickly the processes of decay so nearly obliterate the last vestige of the felled tropical jungle.

Each tree grows one bunch of bananas. When they have reached maturity, but are still green, the tree is cut about half way up its trunk, and the upper part falls gently into the hands of the banana gatherers. The bunches of green bananas are put on hand-cars and hauled to central places, where the banana trains come along and pick them up.

SINGING AS THEY WORK

I have seen 35,000 bunches of bananas loaded into the hold of a ship in a single night, the West Indian negroes singing after the fashion of the hand-drill gangs on railroad and other construction work in the United States. The people who handle bananas on the big plantations of Central America and the West Indies so lose their taste for this fruit that they seldom keep them on their tables at all.

Once I was on one of the biggest plantations in the world, in Guatemala, and, although there must have been several hundred thousand bunches on the trees that were in sight, there was not one ripe banana around the entire settlement of the plantation headquarters.

The banana and its cousin, the plantain, are found in most tropical countries. To the native of Central Africa they yield not only a part of his food and some of his drink, but he gets from them his string, his soap, and his clothing.

He cooks the green fruit of the plantain as a vegetable, and serves the ripe fruit as a dessert. With the banana he makes his flour and sometimes his coffee. He uses the leaves to thatch his house, and also makes them serve him for paper, table-cloths, and napkins. He often uses the stems for fences, the pith as a sponge, and the fiber as a string.

THE PINEAPPLE

Another native of America that has won favor in every part of the world where it is known is the pineapple. Jack Frost is its deadly enemy; therefore it grows only in tropical and subtropical communities; but the refrigerator ship has enabled it to wander to every point of the compass where men and women who love good things to eat are to be found.

Hawaii leads the world in the production of pineapples. It has brought to its fields every variety of this luscious fruit that might add, by cross-breeding, to the size and flavor of its product, so that today canned Hawaiian pineapple and raw Hawaiian sugar serve largely to keep the American flag on the high seas in Pacific waters (see page 88).

Photograph by T. P. Robinson

A BUNCH OF GRAPEFRUIT

Some one has pronounced a grapefruit a lemon that has had a chance. However that may be, Florida finds that they have given her a chance to add $2,000,000 a year to her income.

GATHERING DATES IN ARIZONA

The date was one of the earliest arrivals of all of our plant immigrants, having been brought to America by the Mission Fathers and given a foothold in Arizona and California. While these two States produce a considerable crop of this luscious fruit, still we import the major portion of our supply.

Photograph and copyright by Underwood & Underwood

STRAWBERRIES RIPEN EVERY DAY OF THE YEAR IN SOME PARTS OF CALIFORNIA AND MEXICO

Irrigation, peace, and good farmers would make Mexico a granary of plenty. A touch of water to its thirsty highland soil transforms desert into garden.

Photograph by A. W. Cutler

FORBIDDEN FRUIT: ENGLAND

Adam and Eve and the apple. When Adam got the apple back, there was not much left but the core.

Some plantations are found in Florida, but the frosts frequently nip them there, so they are often grown under sheds to guard them from the cold. The pineapple contains vegetable pepsin, and there are many cases of derangements of the stomach in which it is a valuable aid to the physician.

The orange, the lemon, and the grapefruit are grown where the pineapple thrives, and sugar-cane grows there, too. Traveling through our busy little island, Porto Rico, orange and lemon groves alternate with sugar plantations and pineapple fields. When one comes to the upland region, the coffee "finca" takes the place of the pineapple field, for coffee is the most fastidious of all plants; it will not thrive in the lowlands, and it refuses to grow well at points having too much elevation.

THE OLIVE'S POSITION

If one should draw a ring around the Mediterranean Sea back a hundred miles or so from the shore, and another around southern California, he would circumscribe the two great olive-producing regions of the earth. Although the olive is said to have come originally from Asia Minor, Italy now grows more of them than any other country, while Algiers,

Tunis, France, Spain, Greece, and Asia Minor still give important contributions to the world's crop.

The olive tree has been imported to America, and has thrived well in our southern Pacific regions. There are trees in California which were planted before we signed our Declaration of Independence, and they are still bearing well. California's contribution to the world's olive crop is about 56,000,000 pounds a year.

In southern Europe there is a saying that the man who plants olive trees lays up riches for his grandchildren, and many of the people claim that olive trees often live a thousand years.

The trees are planted from cuttings, sprouts, or the gnarled wooden bulbs at the base of the trunk. They are set about 40 feet apart and begin to bear at two or three years of age, although it requires seven years for them to become commercially profitable. They do not reach their maximum bearing qualities until about thirty years old. A ten-year-old tree may have six or seven gallons of olives on it, while one thirty years old may produce as many as fifty gallons.

In southern Europe and in other lands around the Mediterranean Sea, olive oil to a large extent takes the place of butter. It is used not only in salads, but upon bread and for cooking vegetables. In some localities ripe olives and green oil take the place of both bread and meat. Many a Spaniard, when upon a long journey, ties a wicker basket of olives to his saddlehorn and eats his meals as he travels.

CALIFORNIA'S PREËMINENCE

The systematic growing of nuts is a comparatively new industry in the United States, yet it is one that promises to develop into an important source of food in the future. At the last census there were five million nut trees in bearing in the United States and more than three million more approaching a bearing age. They produced a total of 62,000,000 pounds of nuts, having a value of nearly five million dollars—approximately a dollar a tree.

English walnuts took the lead in weight produced, giving nearly one-third of the total weight and one-half of the total value. The pecan led in the number of trees, with nearly one-third of the total in bearing and more than one-half of the total too young to bear; but they contributed only one-sixth of the total production in weight and one-fifth in value.

California's supremacy as a grower of the newer crops is shown all along the line. Out of 6,793,000 pounds of almonds grown in the entire country, that State grows 6,692,000 pounds; out of 4,150,000 bushels of apricots, it shows a production of 4,066,000 bushels; out of 35,000,000 pounds of figs for the entire country, 23,000,000 belong to her credit; out of the country's total of 2,571,000,000 pounds of grapes, California is credited with 1,979,000,000 pounds.

Practically all of the country's lemons come to us from that State, as does nearly half of the total nut production; nearly all of the country's 16,405,000-pound olive crop; more than two-thirds of the total crop of oranges, amounting to 19,405,000 boxes; a fourth of the peaches and nectarines, and 9,317,000 bushels of plums and prunes out of the country's total yield of 15,480,000 bushels.

SUNFLOWER-SEED OIL

In Russia the people have found the seeds of sunflowers a substitute for olives in the making of oil. The native Russian eats sunflower seeds as we eat peanuts, keeping a handful or so in his pocket and nibbling away at them from time to time. Each sunflower has from eight hundred to one thousand seeds and about forty million pounds of them are raised every year.

An acre of sunflowers yields about sixty bushels of seeds, and these, when pressed, produce about fifty gallons of oil. The Russians use sunflower-seed oil almost exactly as we use cotton-seed oil only they make a greater use of it as a substitute for olive oil than we do. Much of the oil is used for lighting and making candles and soaps.

The date is largely an around-the-Mediterranean crop. It is grown by irrigation in the oases of the Sahara Desert, in the valley of the Nile, in the fertile

Photograph and copyright by Keystone View Co.

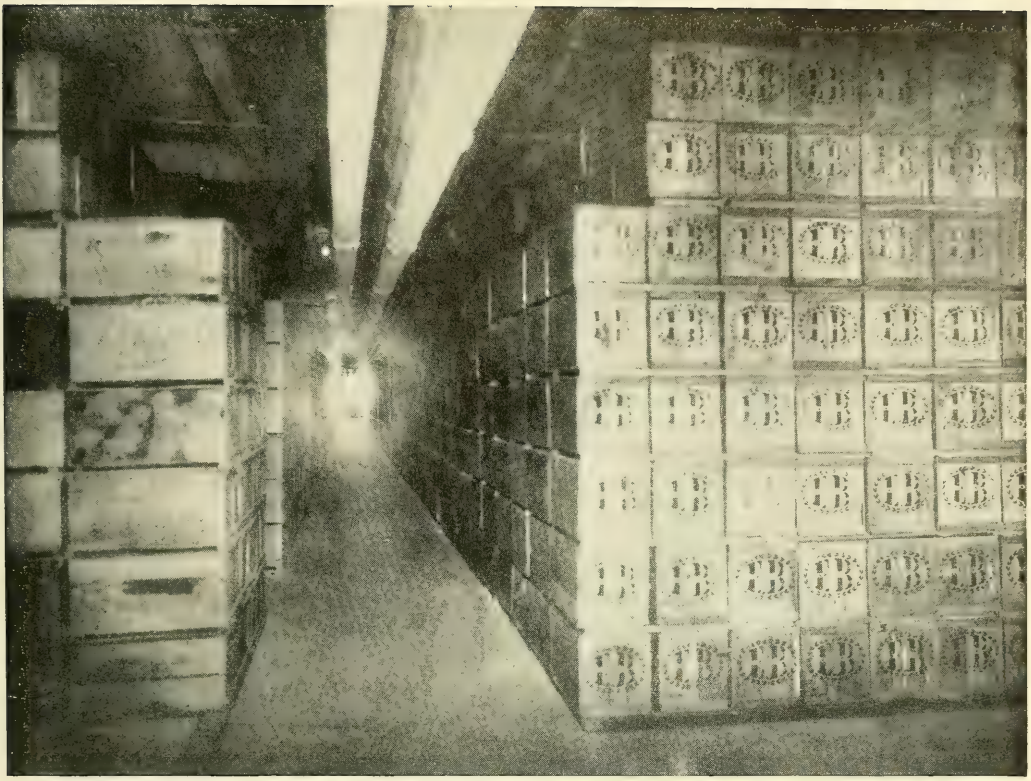
SCENE IN A MODERN HENNERY

The American hen could finance the digging of a Panama Canal every year. She presents the country with twenty billion eggs and nearly half a billion young chickens annually.

spots of the desert of Arabia, and especially along the Shat-el-arab River, at the head of the Persian Gulf. This river is formed by the union of the Tigris and Euphrates, and it flows from their junction for a distance of 70 miles to the Gulf of Persia through some of the richest soil and one of the hottest climates in the world. Here the date palm thrives as nowhere else, and practically the whole land is given up to its cultivation. The date has been in America for generations, having been carried to our southwestern country by the Mission Fathers along with the olive. When grown systematically, it has rewarded those who have cultivated it with fair returns (see page 76).

SPICES AND FLAVORS

The orchid family not only yields some of the most beautiful flowers of which we know, but it also produces one of the most used of all the flavoring agents that figure in the art of cooking. Vanilla is made from the fruit of a climbing orchid, a native of tropical America, but now grown in Java, Ceylon, and other parts



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THE HOME OF THE COLD-STORAGE EGG

of the Orient. The Asiatics use it to flavor their chocolate.

The fruit is a pod. This pod is dried and cured with great care in order to obtain the desired flavor. The characteristic odor is developed during the process of fermentation, which takes place while the pods are drying. The aroma and flavor are due to the vanillin that gradually crystallizes from the pod. The well-cured pods, either whole or powdered, may be found on the market as the vanilla bean or powder; but the more common form is the fluid extract, which is the active principle of the bean drawn out by the use of alcohol.

The American people are the largest users of pepper in the world. In 1913 we bought 27,000,000 pounds of this commodity. It said that pepper was worth its weight in gold during the days of the Roman Empire, and that the first vessel which sailed around the Cape of Good Hope went to procure this favorite spice. The black variety is prepared from the dried unripe berry of a vine which was grown first in southern India, the East Indies, Siam, and China, and in the later ages in the West Indies. For a long time the Dutch nation controlled the trade and tried to confine pepper cultivation to Dutch possessions.

White pepper is generally supposed to be produced from a different spice, but it is, in reality, the same fruit prepared by a different method. It is generally considered better, but, as a matter of fact, it has not as good a flavor as the black variety and is more expensive, the only advantage being in the matter of appearance.

CINNAMON AND CLOVE GROWING

Cinnamon is the inner bark of young shoots of a certain species of cinnamon tree. The shoots are cut carefully from the tree, and the bark is split longitudinally and removed. It is then piled in heaps and allowed to ferment. The bark shrinks on drying, and is then put into bundles ready for exportation.

Photograph by Erdelyi

GOSHERD ON THE BANKS OF THE TISZA: HUNGARY

The goose is much more frequently reared in Europe than in America. It is a bird that has so lately been domesticated that it is still in Europe called the "lag" goose, bringing back to mind the time when some of them "lagged" behind in the days of their migration and permitted themselves finally to be domesticated.

Photograph by A. W. Cutler

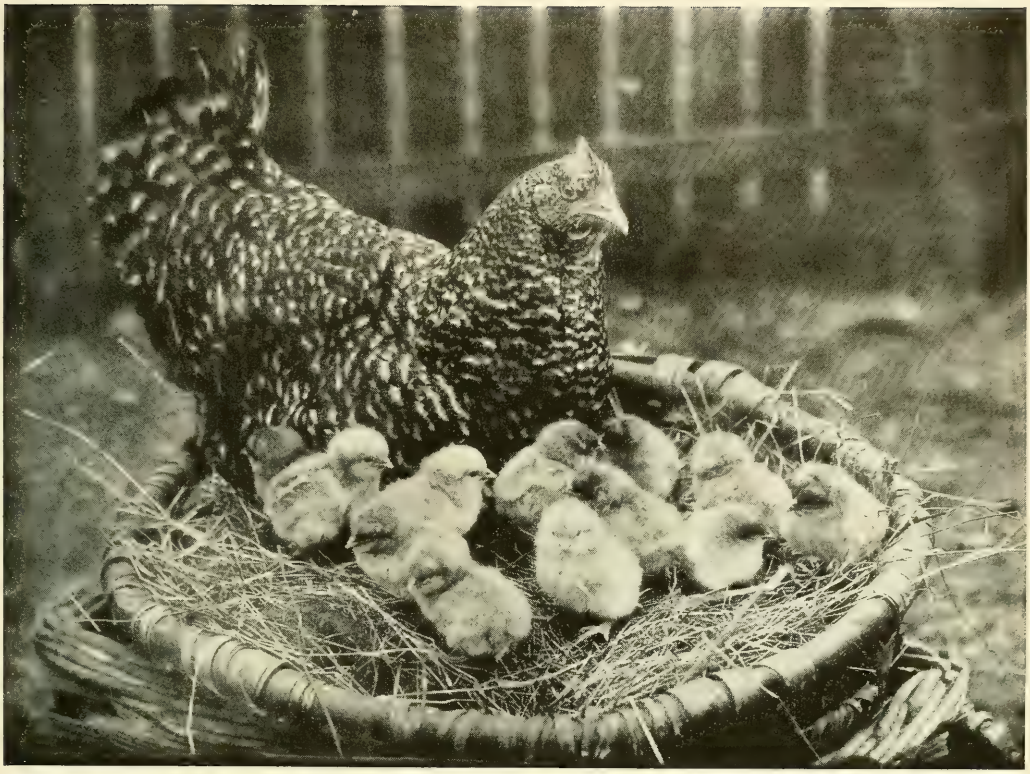
PEASANT WOMEN READY TO START TO MARKET: MEZOKOVESD, HUNGARY

Cloves are the unopened flower buds of a beautiful evergreen tree which grows mainly in the Spice Islands. After picking, the buds are thrown on grass mats on the ground and allowed to dry in the sun, care being taken to shelter them from the dew at night. In about one week they are ready to be packed for exportation. They contain about 16 per cent of a volatile oil which is used largely in the manufacture of perfumery, soaps, and candles.

The nutmeg is the dried kernel of the seed of the fruit of a tropical tree somewhat resembling the orange tree. It is a native of the Malay Archipelago, but is also grown largely in Asia, Africa, South America, and the West Indies. The fruit is gathered when fully ripe, and, as in the case of coffee, the pulp is discarded. The seeds are then dried in the sun or by artificial means. Later the outer coating is broken and the nutmeg or kernel taken out. The outer coating is also used commercially, being exported under the name of mace.

A DROVE OF KANSAS TURKEYS

The heavy draft that Thanksgiving and Christmas makes on the turkey flocks of the country is shown by the fact that the opening of spring finds less than four million alive in the whole United States. Texas is the foremost turkey State, with Missouri ranking second. The American farmer told the census enumerator in 1910 that his turkeys were worth $1.79 each.



Photograph from Henry Ruschin

BUSY BIDDY AND HER BROOD

Sago is made from the pith of the sago palm. This pith is ground into a meal, and the extracted flour, when dried and roasted, becomes the pearl sago of commerce. In many tropical countries the bamboo takes the place of asparagus. The tender shoots of the bamboo are boiled, stewed, or pickled in vinegar.

OTHER TROPICAL PRODUCTS

Tapioca is prepared from the starch of the cassava, a plant grown largely in Brazil and other tropical countries. The starch is extracted, put into shallow pans, and subjected to a low heat. As the moisture is driven off, the heat is gradually raised until the mass forms into irregularly shaped kernels. The cassava plant is closely akin to our own milkweed.

Cocoa is grown on trees which reach an average height of from 20 to 30 feet. The fruit is a pod possessing a thick, tough rind inclosed in a mass of tissue. Embedded in this tissue are some forty or more cocoa beans covered with thin shells. The pods are picked when fully ripe and the seeds extracted and sent to market.

SOME OF THE EARTH'S FREAK FOODS

There is no accounting for the freaks of human appetites. The Roosevelt story of how he got the best work out of the men with sharp-filed teeth by promising them the choicest bits of raw hippopotamus and rhinoceros steak for speed in skinning, will be recalled by many who read the article in the magazines at the time of his African expedition. Capt. Robert H. Bartlett, commander of the *Karluk*, which carried Stefansson to Arctic waters, says that on his return from Herald Island to northern Siberia, he found raw Polar bear meat tasting better than any piece de resistance he had ever eaten in the home country.

The Frenchman likes his snails and wonders how any one who accepts oysters can refuse them. In Canton, China, rats sell for fifty cents a dozen, and a dog steak brings more per pound than a leg

Photograph from U. S. Department of Agriculture

STEAM TRACTION ON A SUGAR-BEET FARM

The sugar beet demands a rich, level soil, which permits the use of every kind of heavy agricultural machinery in the cultivation and harvesting of the crop

Photograph by A. Nielen

A HAWAIIAN SUGAR PLANTATION

Hawaiian sugar was largely responsible for the building of the Tehuantepec Railroad across Mexico, and it practically keeps the American flag on the Pacific today. The Hawaiian sugar traffic through the Panama Canal takes high rank among the commodities handled.

Photograph by R. W. Perkins

A PINEAPPLE FIELD: OAHU, HAWAII

Hawaii has ransacked the tropical world for varieties of pineapples which could be cross-bred for the improvement of the size and flavor of her crop. The result is that Hawaiian canned pineapple has, because of its excellence, found its way into the home of almost every user of this delicious fruit (see page 74).

Photograph from H. N. Rudd

LOADING BANANAS: COSTA RICA

The banana is one of the greatest food producers per acre in the world. We annually import $14,000,000 worth. The banana trade engages more ships flying the American flag than any other business having a foreign end (see pages 7 and 74).

Photograph from U. S. Department of Agriculture

WHERE MILLIONS OF BUSHELS OF AMERICAN CEREALS COME FOR EXPORT: JERSEY CITY TERMINAL OF A GRAIN-CARRYING RAILROAD

of mutton. The Chinese mandarin pays thirty dollars a pound for the birds' nests from which his soup is concocted. In parts of the West Indies the palm worm is stewed in fat, while certain African tribes are as fond of caterpillars as an American is of reed birds on toast. The Turk is as disgusted with the oysters we eat as we are with the fish the Corsican relishes.

Eating earth, or geophagy, is a common thing in many parts of the world. In some parts of Europe a butter is made of fine clay, and in other regions various kinds of earths are sold in the open market. The Persians use some varieties of soil in making their sweetmeats, while in Mexico the eggs of certain species of flies are used by the Indians in making a food paste which is regarded as a great delicacy (see page 41).

FOOD IMPORTS AND EXPORTS

It is interesting, in view of war conditions in Europe, to study the figures of international trade as applied to the principal foodstuffs moving across the boundaries of the various nations.

According to the Department of Agriculture statistics, Austria-Hungary imported 29,000,000 bushels of corn in 1912, as compared with 8,000,000 bushels in 1911 and 3,000,000 bushels in 1910. Germany's importations of corn during the same years were as follows: 1912, 45,000,000 bushels; 1911, 29,000,000 bushels, and 1910, 23,000,000 bushels. In 1912 Germany and Austria-Hungary had a total importation of 74,000,000 bushels. During the same year Bulgaria and Roumania had a surplus of 75,000,000 bushels.

In 1912 Germany imported 85,000,000 bushels of wheat and flour, being the only one of the Central Powers to import such commodities. She exported 20,000,000 bushels of the same products. Bulgaria had a surplus of 14,500,000 bushels and Austria-Hungary a surplus of 1,000,000 bushels. Their neighbor, Roumania, had a surplus of 57,000,000 bushels that year. If the Central Powers get Roumania's wheat crop, they still have a wheat shortage of more than 12,000,000 bushels. If they do not get it, their shortage is 69,000,000 bushels.

Photograph and copyright by Keystone View Co.

MOUTH OF ERIE CANAL: BUFFALO

"Truly the man who dines well ought to be a deep student of geography, for all races, all nationalities, all types of people, all points of the compass, all latitudes—continent, island, river, and sea—all must come to him as he looks over the bill of fare and tries to find those things that delight his palate" (see text, page 107).

According to the Statesman's Year Book, Germany in 1912 had a surplus of rye, the net exports of that crop being valued at $22,000,000. On the other hand, she imported barley to the value of $100,000,000, corn to the value of $26,000,000, butter worth $40,000,000, and $28,000,000 worth of lard.

WORLD STARVATION AVERTED

The economists of a hundred years ago did not foresee the revolutionizing discoveries that were to come in the century ahead of them. They had no hint that it would go down in history as one of the most momentous of all the ages, from the standpoint of the world's food supply; for three discoveries in the field of food production, any one of which well might stand for a whole millennium of progress, were made by a single generation of men.

When Cyrus McCormick gave to the world the first reaper, he ushered in the age of agricultural machinery, enabling one man to do the work that required five before, and making him able to care for any crop the earth might give him. The world's production will never get too large for the machine-aided farmer to handle.

It was only a little while later that the great chemist Leibig worked out the principles of plant nutrition and introduced

Photograph from U. S. Department of Agriculture

THE "BADENIA" TAKING ON A CARGO OF WHEAT FROM A BALTIMORE ELEVATOR

The long pipes extending from the elevator to the ship carry the wheat by gravity from its bins to the hold of the ship. In unloading, the grain is carried out of the ship by steam-driven endless belts of buckets. In 1913 the United States supplied the outside world with 92,000,000 bushels of wheat, 12,000,000 bushels of flour, 17,000,000 bushels of barley, and other breadstuffs in proportion.

the era of commercial fertilizer. Before his discoveries were made, man had only an empiric control over the productivity of his land. He could only sow the seed and then trust to Providence for his harvest.

And he knew that every harvest saw his land less productive, for each crop drew its draft upon the bank of the soil and cut down the account of fertility just that much. It was a case of always drawing out and never putting in, and even nature's deposits must ultimately be exhausted under such a procedure. The result was that it began to appear that the agricultural machine would outlive its day, since soil exhaustion appeared inevitable and world hunger an unavertible calamity.

EXHAUSTION OF THE SOIL NEEDLESS

But when Liebig discovered that nitrogen, phosphorus, and potash are the only three indispensible articles in the menu of the plant, and that if it is given these it can thrive year after year and generation after generation on the same soil without impoverishing it, he laid the foundation of the new science of soil fertility—a science that permits man, through the use of proper fertilizers, to go on and on in developing and improving his ground.

Who that is a student of farming has not seen a run-down farm on one side of a line fence and a highly productive one on the other. I have known land to have its per-acre production of wheat increased threefold and its production of

Photograph and copyright by Keystone View Co.

A NATIVE BAKER AT WORK: ALEXANDRIA, EGYPT

The Egyptian baker's aim is to get the biggest possible loaf out of the smallest possible amount of flour, with the result that the bread of the Nile Valley is largely a hole wrapped in a crust. The material is rolled out like pie crust and the edges are joined all around. Heat puffs it up into a balloon of bread.

corn fourfold in less than five years, when it passed out of the hands of Peter Tumbledown and into the hands of his prosperous neighbor on the other side of the old line fence. And for a quarter of a century that land has been growing better with every crop rotation. It was the application of Liebig's discoveries that accomplished this result.

What, then, becomes of the argument of that school of thought which says that soil exhaustion is the lesson of all agriculture and all history?

The age of soil fertilization has confirmed to mankind the benefits of the age of agricultural machinery, and will enable the race to transmit them to his children and children's children for generations to come.

SAVING OUR MEAT SUPPLY

If McCormick taught the world how to sow and reap, so that unborn millions of people might have plenty, and if Liebig showed mankind how to insure themselves against the momentous evil of run-

Photograph and copyright by Keystone View Co.

MAKING THE "FLAT BREAD" OF THE NORWEGIAN PEASANT

This Norwegian woman, now past her threescore years, is baking the well-known flat bread under a little shelter of dried branches. The dough for this bread is in the shallow dish in front and to the left of the old lady and is made of coarse barley meal and water. After being rolled thin, it is removed to the round, flat baking-stone in the foreground, under which a fire of faggots is kept burning. It is then stored in a dry place for the winter, when it forms one of the chief foods of the peasants.

down farms, Pasteur signalized that same generation with the lesson of how to save our domestic animals from the ravages of infectious diseases, and through that magnificent discovery gave man a weapon against human as well as animal infections.

In the middle period of the nineteenth century an epidemic of anthrax fever broke out in Europe and ravaged the cattle regions of the Old World. Not only was it one of the most dreaded of diseases because of its great fatality rate, but it is also a most loathsome disease, producing sores and abscesses in its victims, and it attacks animals and men alike.

By the middle of the century sheep and cattle raising in some parts of Europe was practically abandoned; in many places the dairying industry was wiped out, and it seemed that nothing could

Photograph and copyright by Keystone View Co.

ANOTHER VIEW OF THE NORWEGIAN FLAT-BREAD BAKERY

The pile of sheets of bread to the left of the old woman shows that in spite of her old age she is a faithful worker

stop the constantly extending sweep of the malady.

At that time the world did not know that infectious diseases were caused by germs. A little later the science of bacteriology began to develop, and the great French savant Pasteur finally succeeded in demonstrating that anthrax fever is caused by a definite germ. After determining the cause of the disease, he undertook to work out the problem of combatting it.

He found that the germ of anthrax fever, when cultivated in chicken broth for several generations, loses its ability to produce the disease. Not only this—he proved that when this bacillus loses its ability to produce disease, it gains a new quality, that of rendering animals immune from the attacks of uncultivated bacilli. With these facts in hand he announced that he could render sheep and cattle immune against anthrax by inoculation.

ONE OF THE MOST DRAMATIC SPECTACLES OF HISTORY

When he made this announcement he was greeted by a storm of derision on

Photograph by A. H. Blackiston

MAKING TORTILLAS: MEXICO

The tortilla is a sort of flapjack rolled out on a primitive "dough board" of stone, with a rolling-pin which Nature manufactured by centuries of water-attrition. The oil-can in the foreground is the water bucket of the peons of Mexico.

Photograph by Henry Ruschin

A GERMAN ARMY FIELD BAKERY

the part of the uninformed and by a wave of skepticism at the hands of the scientific world. The president of an agricultural society offered to furnish him a drove of 50 sheep, half of which were first to be inoculated with the cultivated virus, and later the whole flock was to be inoculated with the uncultivated variety. They were then to be kept together in one pen under precisely the same conditions. If the vaccinated sheep remained healthy and the unvaccinated ones died of anthrax, it was to be accepted that Pasteur had proved his case.

The challenge was accepted, two goats being substituted for two of the sheep, and ten cattle being added. On May 5, 1881, the preventive inoculation of half of the sheep was undertaken, and was repeated on May 17. On May 31 all sixty of the animals were inoculated with uncultivated germs.

Two days later a vast crowd, composed of veterinary surgeons, newspaper correspondents, farmers, and scientific men, gathered to witness the closing scene of this remarkable test. And they saw one of the most dramatic spectacles in the history of peaceful science. Every animal that had not been vaccinated with the anthrax-preventing virus was either dead, dying, or in the last stages of the disease, while not a single one of those which had been vaccinated had contracted the malady. In the course of a few hours every infected animal in the compound was dead, while every one that had been vaccinated was in perfect health.

This discovery soon released Europe from the thraldom of the epidemic of anthrax, and it laid the foundation for preventive medicine as applied to domestic animals so firmly as to insure mankind against the conquest of his animal food supply by the microscopic creature that cause such epidemics as anthrax cholera, and the foot-and-mouth disease.

TEACHING PEOPLE HOW TO FARM

The great need of the world in the future is not so much more acreage to cultivate as a better handling of the acreage already under cultivation. While it is estimated that the total area now actually used in growing crops amounts to

Photograph from the Washburn-Crosby Company

THE MINNEAPOLIS MILLING DISTRICT AS SEEN FROM THE MISSISSIPPI RIVER

This is the center of the flour-producing district of America. A single plant has a capacity of 40,000 barrels of flour a day. It uses 150 carloads of wheat daily and turns out flour enough to furnish 9,000,000 people with their daily bread. From incoming wheat to outgoing flour there are twenty-three processes.

Photograph from Corby Bros.

THE BREAD RACKS OF A MODERN BAKERY IN THE NATION'S CAPITAL

There are 24,000 bakeries in the United States, employing 100,000 people and producing $400,000,000 worth of bread, crackers, pies, and cakes a year. These figures do not include those which do a business of less than $500 a year nor hotels. Our bakery products are worth as much as those of our creameries and vegetable canneries together.

Photograph by A. H. Blackiston

SECRETARY OF AGRICULTURE HOUSTON PRESENTING WALTER LEE DUNSON A DIPLOMA AS THE CHAMPION BOY CORN GROWER OF THE UNITED STATES

only about 15 per cent of the total landed area of the world, it has been demonstrated that with scientific agriculture this area itself might suffice to feed a population vastly greater than that now living.

With all of her teeming millions, only 18 per cent of Asia's land, 12 per cent of that of the Americas and Africa, 27 per cent of that of Europe, and 5 per cent of that of Australia have ever felt the touch of the plow. Without encroaching at all upon the world's forests, but using only the steppes, pampas, savannas, and prairie lands, there might be added to the earth's farming lands an area twice as great as that now under active agricultural operations.

The United States has been working along lines looking more to the extension of scientific methods to the present cultivated acreage, than to the extension of farm operations to new acreage. The bulk of the $30,000,000 it now spends annually, through its Department of Agriculture, is for the improvement of farming methods. In latter years a program for the taking of the gospel of good farming to the farmer himself, and demonstrating it in practice, instead of writing it down upon paper, has been productive of very wonderful results.

In the club work of the last fiscal year hundreds of county agents of the Department of Agriculture, working in thirty-three States, went out upon the farm and showed the farmers themselves how to increase their yields. The thousands of farmers who accepted the offer to farm under the direction of the Department of Agriculture increased their yield of corn nine bushels per acre, their wheat seven bushels per acre, and their oats ten bushels per acre.

Photograph from U. S. Department of Agriculture

JERRY MOORE, OF FLORENCE COUNTY, SOUTH CAROLINA

Jerry is a twentieth century farmer. South Carolina soil returned him 228¾ bushels of corn to the acre.

TEACHING THE YOUNG IDEA HOW TO "SHOOT" GOOD CROPS

But probably more significant even than the work among the farmers themselves, has been the work among the boys and girls. Sixty thousand boys and fifty thousand girls were enrolled in club work in the Southern States last year. Many of the boys were organized into clubs to raise pigs and poultry, others into clubs for demonstrating the advantage of four-crop rotation in southern farming, and still others into clubs for the growing of winter legumes for soil improvement. Girls were taught to make house gardens and to preserve for home use the garden products as well as the waste fruits and vegetables of the entire farm.

In the north and northwestern States 150,000 boys and girls were enrolled, the leading club projects being the growing of corn and potatoes and garden and canning work.

The success that has followed these activities has been wonderful, demonstrating to the farmers that their children can accomplish marvels of which they never dreamed. Ten girls in Mississippi produced 27,850 pounds of tomatoes on ten one-tenth-of-an-acre plots. They were working as a team for a prize given by Kentucky business men. The value of their tomatoes was $1,179, and the profits on their joint plots—together only one acre in extent—amounted to $868.

Ten boys in Alabama averaged 171 bushels of corn to the acre. The people in their several communities no longer have a contempt for the farming experts of the Department of Agriculture. Heretofore they have always urged that with the money of Uncle Sam to spend it was but natural that large yields could be gotten, but that the average farmer could not afford to duplicate these methods. The boys and girls who have taken part in these contests have given such an effective answer to these contentions that even the inertia of the indifferent farmer has been overcome. Many other kinds of club work is being done.

Photograph from U. S. Department of Agriculture

CLUB MEMBERS SELECTING THEIR SEED IN THE FIELD BEFORE FROST

The farmer who sees that every grain he puts into the ground is one able to produce a hardy sprout lays the foundation for a big crop

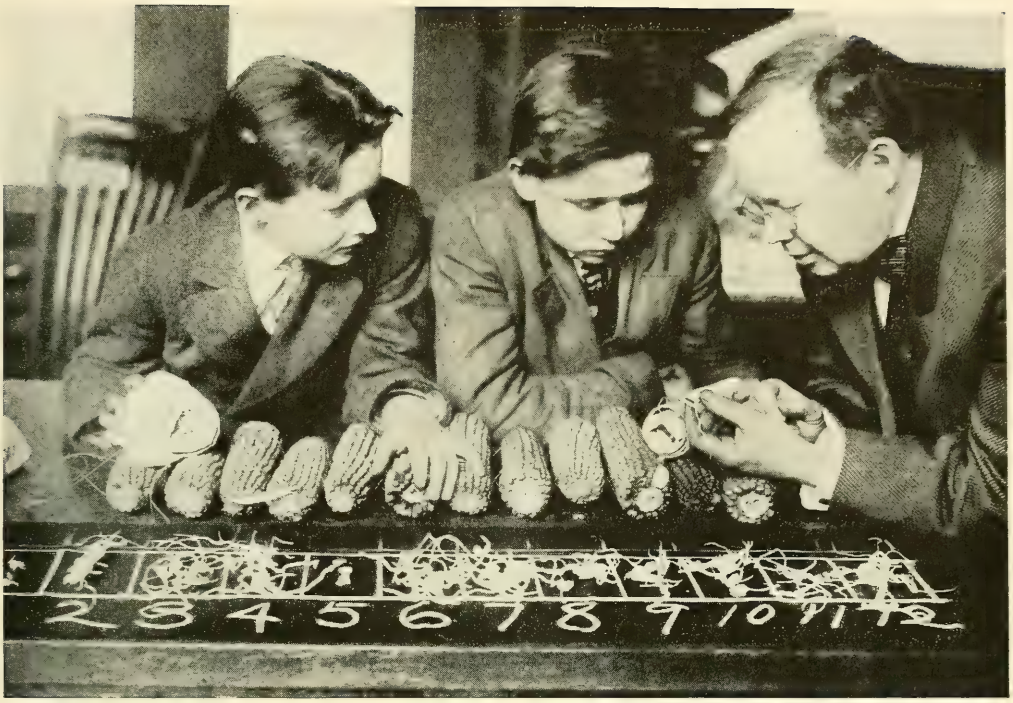
In Oregon a packing-house distributed a carload of brood sows among the children of the Hood River region of that State and of Washington. They were sold on credit to these boys and girls, who agreed to raise them according to the Department of Agriculture specifications.

The buyers were charged 6 per cent interest on the purchase price, to be paid out of the profits from the pigs raised. The school officials of the Hood River region have charge of the experiments, and those boys and girls doing the best work and making the best reports are to be awarded scholarships to the State University, and other prizes.

THE STORY OF A LOAN

A farmer in Macon, Georgia, who carries a large bank account, went to his bank with his twelve-year-old son and endorsed the latter's note for ten dollars. The cashier inquired of him why he was having his boy borrow ten dollars when he himself had so much money in the bank. The farmer replied that his son was going to enter a boys' pig club, and that he wanted him to acquire a banking experience as he went along. He said that it was worth ten dollars to him to see how his boy handled the loan.

An Alabama philanthropist hit upon another idea for increasing pig-raising in his community. He bought twenty pigs and sold them to as many boys, the bargain being that when the boys brought him two pigs to take the place of the one thus sold, the debt should be considered discharged. The philanthropist then took these two pigs and gave them to two



Photograph from U. S. Department of Agriculture

EXPLAINING THE RAG-BABY TEST IN THE GERMINATION OF SEED CORN

Six grains of corn are taken from each ear and wrapped in rags, which are then moistened and set away for germination. After the grains have had time to sprout, the rags are opened and the seeds examined. Some ears yield no sprouting grains; others yield grains that sprout weakly; still others yield grains with a "batting average of 1,000 per cent." These are the ones which produce good corn crops.

Photograph by Frank H. Bothell

CHILDREN BRINGING SAMPLES OF MILK TO BE TESTED FOR BUTTERFAT: BOUNTIFUL, UTAH

Photograph from U. S. Department of Agriculture

POLKTON POULTRY CLUB: ANSON COUNTY, NORTH CAROLINA

"If the rural housewife will not come to the school of domestic science, we will take that school to her." Such is the latest idea in agricultural extension work. Under the new Smith-Lever Law, the U. S. Department of Agriculture will, besides organizing dairying, poultry, textile, and food study clubs, giving lectures, and conducting correspondence courses, send its agents directly into the homes and show the housewives how to make all sorts of labor-saving devices, from a fireless cooker costing twenty-five cents to a roller table to carry the family meal from the kitchen stove to the dinner table (see text, page 101).

other boys under similar terms. In this way he has planned an endless chain of pigs and an ever-increasing circle of boy club members.

It seems certain that the wonderful results achieved through the boys' and girls' clubs in the United States will eventually lead to their adoption by every progressive government. Probably no other work can be as influential in promoting the world-wide adoption of modern methods of farming as the work among the children.

That habit of mind of the grown-up which makes a man ashamed to be outdone by a child, serves to stimulate the adult farmer when the children of his community are engaged in club work. The enthusiasm of youth is thus capitalized, and the nearly 300,000 boys and girls who are now engaged in this work in America, will form a future army of food producers, who will not only be good farmers and farmers' wives, but who will inspire hundreds of thousands of others to profit by their examples.

ALL ROADS LEAD TO THE DINNER TABLE

Could we, like the great French writer, Maupassant, turn lose our fancy as we dine, we could see a great army of men and women working that we might eat. The appetites of men now levy tribute upon all the continents and all the seas,

Photograph from U. S. Department of Agriculture

EARL HOPPING AND HIS GOAT

If every American farmer raised as much corn to the acre as this Arkansas boy, with a one-goat team, the United States alone would grow as much corn as the whole world produces, with a billion bushels to spare (see text, page 29).

and where once all roads led to Rome, now they come directly to our dinner tables.

Let us sit down to dinner and go over the menu and try to list those who have assisted in the preparation of our meal.

At the top of the list come olives and salted nuts. The olives mayhap are from Spain, the almonds from California, and the pecans from Texas. The salt on the nuts was prepared in New York State. Also we have celery that came from Michigan.

Then comes the soup. Without a cookbook at hand, this writer will not pose as an authority on the ingredients of soup, but it may be Chesapeake Bay clam chowder, which certainly has some pepper from Africa in it and other ingredients from far and wide.

Our fish is salmon from Alaska, and our prime ribs of beef came to our table through the Kansas City "packing-town." Our potatoes came from Maine, our boiled rice from China, our string beans from Florida, and our tomatoes from Maryland.

Next comes our salad, and it contains—if a man may guess at the contents of salads and dressings—Mexican peppers, Hawaiian pineapple, Sicilian cherries, Pennsylvania lettuce, Iowa eggs, Spanish olive oil, Ohio vinegar, California mustard, and Guiana red pepper.

When we get down to the ice-cream, we eat Virginia cream, Cuban sugar, Ecuadorean vanilla, and Mexican chocolate. The cake that goes with it is made of butter from Illinois, flour from Minneapolis, made from wheat grown in North Dakota; baking powder from Pennsylvania, and other ingredients.

When it comes to coffee, if we are fastidious we will have issued a draft on both Turkish Arabia and Dutch Java, or if we are only folk of every-day taste we

Photograph from U. S. Department of Agriculture

A CHAMPION UTAH GARDENER CONVERTING HER POTATOES INTO STARCH

The total value of the product of boys' and girls' clubs and those for women in Utah for 1915 amounted to $63,843, secured at a cost of $3,358 for the extension work. It is the ultimate purpose of the United States Department of Agriculture to spend $5,000,000 a year in teaching the farmers' wives and daughters the art of home economics.

Photograph by Frank H. Bothell

BOY CLUB MEMBERS LEARN HOW TO MAKE BIG PORKERS OUT OF LITTLE PIGS

An Alabama philanthropist has applied the endless chain idea to pigs. He bought twenty little sows and sold them to as many boys. Each boy undertook to raise his pig and to give the philanthropist two little ones from the first litter farrowed as payment. These in turn are to be delivered to other boys on the same terms, the philanthropist assuming all risks (see text, page 102).

Photograph by Miller Photo Co.

STACKING HAY BY HORSE-POWER

The United States devotes 72,000,000 acres of land to hay and other forage crops. Were this used to grow potatoes, even at our present rate of production, it would yield 6,480,000,000 bushels, which is more than the whole earth produces today. The passing of the horse will release this area to human food production.

A MEXICAN OUTDOOR BAKERY

Although the tortilla reigns in Mexico, revolution or no revolution, bread baked in outdoor ovens is its principal rival for popular favor. The oven is first heated by a roaring fire. After it is thoroughly hot, the fire is withdrawn, and the unbaked dough put in its place. The heat of the brick bakes the bread.

Photograph by Frank H. Bothell

RUTH BYBEE'S EXHIBIT AT THE STATE FAIR, UTAH

This little girl made every article in the exhibit and dressed the doll for good measure. Her Battenburg lace, her hand-painted china, no less than her jellies, jams, and pickles, show how good training may make a girl independent (see text, page 101).

will content ourselves with the Brazilian product.

THE WORLD OUR SERVANT

And so, when we come to reckon up those who have helped produce the raw materials of which our foods are made, we find the clouted African savage and the American stock grower; the South American Indian and the California truck farmer; the Javanese coffee picker and the Virginia dairyman; the turbaned Arabian and the New York orchardist; the Chinese coolie and the Dakota wheat farmer; the Mexican peon and the Chesapeake Bay fisherman; the Porto Rican planter and the Hawaiian sugar grower; the Spanish olive packer and the Alaskan Eskimo fisherman.

Yet all these neglect the matter of transportation. Our food comes to us on the heads of Indians, on the backs of donkeys, drawn in carts by huge water buffaloes, aboard the "ship of the desert," on wheelbarrows propelled by Chinese coolies. Steamships, railroad trains, auto trucks, and delivery cars have all played their part in the great work of catering to discriminating appetites.

Truly the man who dines well ought to be a deep student of geography, for all races, all nationalities, all types of people, all points of the compass, all latitudes—continent, island, river, and sea—all must come to him as he looks over the bill of fare and tries to find those things that delight his palate.

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THE NATIONAL GEOGRAPHIC MAGAZINE

HOW OLD IS MAN?

BY THEODORE ROOSEVELT

OF RECENT years scientific writers have for convenience sake distinguished as prehistory that part of man's long history on this earth which precedes the period for which we possess written records, or at least records that may be treated as in some sort their equivalent.

This prehistory of man is, of course, immensely longer than what can, by any stretch of language, be called his true history. At present our historical records begin in Egypt and Mesopotamia, using the latter word to include the entire country adjacent to the Tigris and Euphrates; and the first dim indications of anything that can properly be called history do not go back seven thousand years, while it is not until some five thousand years ago that we begin to be on continuously firm historical ground.

At that time Europe was still in the prehistoric stage, and its inhabitants knew practically nothing of either metals or writing, being in the neolithic or polished stone cultural stage. In America history cannot be said to have begun much before the advent of the white man, although there are extraordinary architectural remains of old and strange civilizations in Mexico, Central America, and Peru.

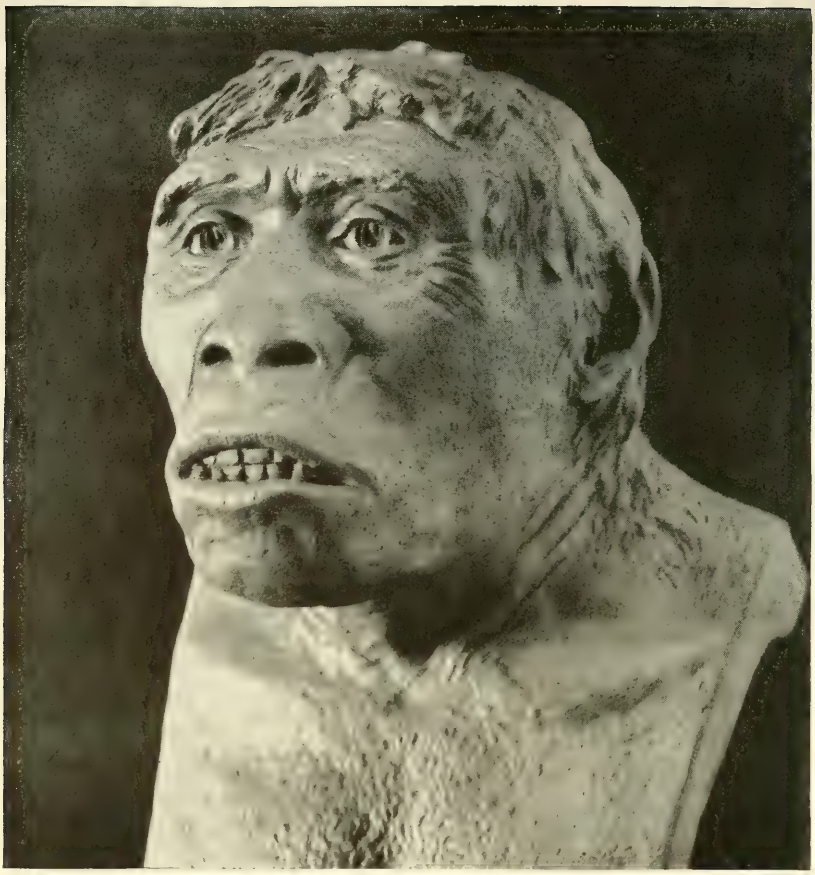
"Old," however, is a relative term. The earliest monuments beside the lower Nile and lower Euphrates, like the earliest monuments on the high plateaus or in the dense tropical forests of the new world, are purely modern—are things of yesterday—when measured by the hoary antiquity into which we grope when we attempt to retrace the prehistory of man, the history of his development from an apelike creature struggling with his fellow-brutes, to the being with at least longings and hopes that are half divine.

All our knowledge of man's slow progress during the immense stretch of time covering this development has been obtained during the last two generations; it is still of a sketchy and fragmentary kind, and we cannot hope that it will ever be complete; but already we know enough to indicate the rough outlines of some of the most important of the developmental stages, and as regards certain of the later stages to fill in various details.

THE REPTILES DISAPPEAR AND MAMMALS RULE THE EARTH

In geological or paleontological parlance, the Age of Mammals is known as the Tertiary period. At the beginning of this period the gigantic creatures with which the Age of Reptiles, the secondary period of the earth's history, culminated, had all died out.

The mammals, which for ages had existed as small, warm-blooded beasts of low type, now had the field much to themselves. They developed along many different lines, including that of the primates, from which came the monkeys, the anthropoid apes, and finally the half-human predecessors of man himself. At about the time when these last appeared



Photograph from Osborn's "Men of The Old Stone Age"

THE APE MAN OF JAVA, A PREHUMAN CREATURE WHO LIVED PROBABLY 500,000 YEARS AGO (SEE PAGE 120)

the Tertiary, or so-called Age of Mammals, came to a close with what is known as the Pliocene period.

The earth then already bore substantial resemblance to what it is today, although with a warmer climate, and the mammalian life, although infinitely richer than at present, included creatures substantially kin to most of those now existing. Laymen must remember that these different ages or periods merged gradually into one another, and that the names we give them are merely necessary terms of convenience.

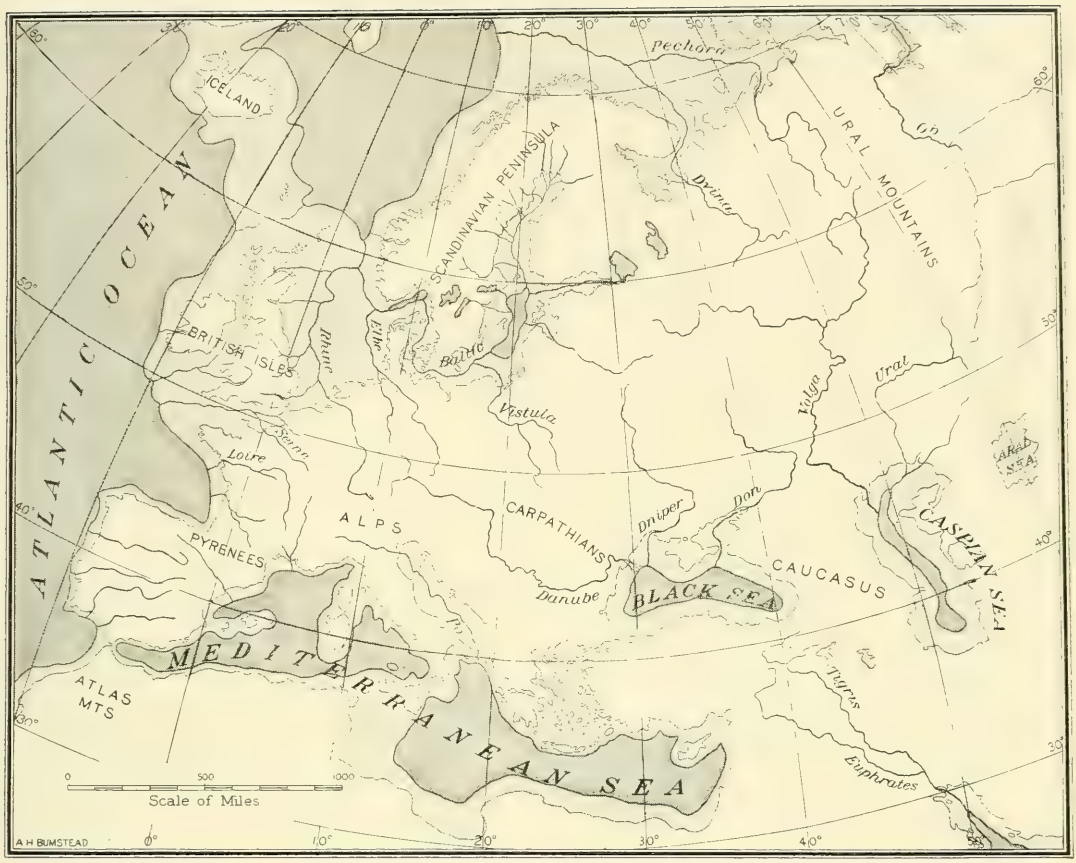
The Pleistocene Age followed the Pliocene. It is sometimes called the Quaternary. Throughout its duration the world went through many physical changes. Continents rose and fell, became connected and again disconnected; mountain chains were worn down and others thrust upward; lakes filled and vanished; periods of great cold were followed by periods of warmth.

Because of these changes the waves of life flowed hither and thither. During its early stages this age could appropriately be called the Age of the Horse, the Lion, and the Elephant, for these three beasts in many forms abounded on every continent of the globe except Australia.

But man was slowly developing from the half-human to the wholly human throughout this immense period of time, and at its close the Age of Man may fairly be said to have begun.

THE RECORDS SHOW THAT MAN HAS LIVED IN FRANCE FOR AT LEAST 100,000 YEARS

It is in France that the most complete records of prehistoric man are found—



AN OUTLINE MAP OF EUROPE AT A PERIOD WHEN THE BRITISH ISLES AND SCANDINAVIAN PENINSULA WERE A PART OF THE MAINLAND

Europe was then in the period of maximum continental elevation, in which the coast-lines were widely extended, connecting Africa and Europe in a single vast peninsula and affording free migration routes for animal and human races north and south, as well as east and west.

records which show a continuous human occupation of the region for at least a hundred thousand years; and French archæologists have taken the lead in deciphering these records. The countries of Europe immediately surrounding France also yield invaluable records; and in consequence our knowledge of the prehistory of man is almost, but not quite, confined to his development in Europe.

All the earlier divisions of this prehistory, stretching over an immeasurable period of time, are included in the culture stage known as paleolithic, so called because during these many hundreds of centuries the successive races of men used only chipped stone tools and implements. Following this immensely long Old Stone Age came in quick succession the relatively short ages known as those of New Stone, or polished stone, of Bronze, and of Iron.

THE MOST IMPORTANT BOOK ON THE EVOLUTION OF MAN SINCE DARWIN'S "DESCENT OF MAN"

The best book dealing in concise form with the hoary antiquity of man as he was up to the end of paleolithic times has just appeared and is by one of our fellow-countrymen. The author is Henry Fairfield Osborn, of the American Museum of Natural History.

Dr. Osborn's book covers in masterly manner the Old Stone Age of Europe. It therefore covers substantially all that we now know of the development of hu-

From a drawing by Charles R. Knight

THE IRISH ELK OF PLEISTOCENE EUROPE

This magnificent deer (found fossil in the Irish peat-bogs) was not a true elk, but an enormous fallow deer (recent examples of which still exist in Europe). The spread of the antlers was very great, as much as 10 feet in some cases. The animal stood 7 feet at the shoulder, and the head and feet were small in proportion to the general bulk. The females had no antlers. This deer first appeared in western Europe during the first inter-Glacial age, before the advent of man in western Europe.

manity* from the days of the ape-man of Java, through the hundreds of thousands of years during which the chinless pre-men dwelt in Europe, to the time when men of substantially the present type hunted the mammoth and the bison north and south of the Pyrenees, and drew and painted the great beasts on the walls of their home caverns.

This is the crucial period in the evolution of man from a strong and cunning brute into a being having dominion over all brutes and kinship with worlds lying outside and beyond our own. In Mr. Osborn's book this period is for the first time covered as a whole and treated as fully as our present knowledge permits. It is the most important work on the evolution of our own species that has appeared since Darwin's "Descent of Man."

Many works of high merit have dealt with phases of what is here covered, and some suggestive books of larger scope have been written. The whole subject has now been covered by a writer whose exhaustive and many-sided knowledge, whose long scientific training, whose natural insight, and whose singularly just and fair temper enable him to give us the first full, clear, and critical presentation and interpretation of all that has been discovered and soundly determined since Darwin wrote that one of his masterpieces which especially dealt with man.

This is a strong statement. Yet it is verified by an examination of the multitudinous works treating of the matter. There are books of the highest value

*"Men of the Old Stone Age: Their Environment, Life, and Art," by Henry Fairfield Osborn. New York: Charles Scribner's Sons.

MAP OF EUROPE, SHOWING THE GREAT SHEET OF ICE THAT COVERED THE BRITISH ISLES, SCANDINAVIA, GERMANY, AND HALF OF RUSSIA DURING THE SECOND GLACIAL AGE

The ice fields and glaciers, shown in white on this map, then reached their greatest extension, and eastern Europe was depressed to such an extent that the Black and Caspian and Aral seas formed one continuous body of water. After the ice retreated the Heidelberg man appeared, an immigrant from Asia, probably 250,000 years ago (see page 119).

dealing with the archæological side, such as that of Dechelette, recently killed in battle (for, incidentally, the French archæologists do not permit their studies of the dead to shrivel their patriotic devotion to living duty), and the magnificent volumes of Cartaillac, Brenil, and Obermaier, which we owe to the generous scientific enthusiasm of the Prince of Monaco.

There are other books on the geological side of the period, such as the notable volumes of Chamberlin and Geikie, which could have been written only by specialized experts. There are many studies of human remains and of the remains of the accompanying beast faunas by French, English, and German writers. All of these are indispensable to the scholar; but each covers only one facet of the crystal.

Finally, there are books dealing with the general subject—excellent books—but none of them possessing all the qualities which are essential to the full understanding of the problem. Lord Avebury's "Prehistoric Times" was written when it was still necessary to argue with those who disbelieved in the antiquity of man, their reasons being substantially similar to those of the other conservatives who a couple of centuries earlier treated as impious the statement that the earth went round the sun.

From a drawing by Charles R. Knight

A CONTEMPORARY OF THE HEIDELBERG MAN, LONG SINCE EXTINCT: THE WOOLLY RHINOCEROS TICHORHINUS, PLEISTOCENE

The woolly rhinoceros (Pleistocene), a European form found frozen in Siberian ice fields. This singular creature, like the mammoth, was covered with long reddish wool, which served as an effective protection against the bitter cold of its native home (see page 119).

In Osborn's book for the first time everything is put together — geology, paleography, the known climatic changes, the plant life, including the succession and migrations of the various floras; the animal life, including the succession and migration of the various great mammalian faunas; and finally what is known of ancient man himself in these surroundings.

WHEN THE BRITISH ISLES WERE PART OF FRANCE AND THE BALTIC A FRESH-WATER LAKE

During the immense period of time when the Old Stone man dwelt in western Europe it was, as now, a peninsula of the huge Eurasiatic landmass. Again and again it was partially covered by ice-sheets from different centers of dispersal, chiefly the Alps and the region that includes what is now the Baltic Peninsula.

Slowly the land rose and fell. It was connected and disconnected by narrow land bridges with Africa. When the land encroached on the sea the British Islands became part of France and Flanders, and the Rhine and the Seine were huge rivers, compared to which the present-day Rhine and Seine look like brooks. The Baltic became a fresh-water lake. Then, again, the ocean recovered its own and extended far beyond its present limits. These changes were not cataclysms; probably changes as great are at this moment going on in the world. But to human perceptions such earth movements are so gradual as to be impossible of notice by any individual or generation.

UNLIKE ASIA AND THE AMERICAS, EUROPE DID NOT ORIGINATE BEASTS OR MEN

These climatic and geographic oscillations perhaps explain the apparent fact that Europe was not a center of origin

From a drawing by Charles R. Knight

THE SABER-TOOTHED TIGER, ANOTHER CONTEMPORARY OF THE HEIDELBERG MAN

Remains of this great feline are found in many portions of the globe, the particular specimen from which the picture was made being of South American origin. In many ways the creature was not a true cat, the high shoulders and short tail being rather bearlike than otherwise. The feet, however, were truly feline and were armed with many powerful claws. The long, saber-like canine teeth must have been very effective weapons, and could, no doubt, inflict terrible wounds upon an adversary. These teeth projected on either side of the lower jaw when the mouth was closed (see pages 119 and 123).

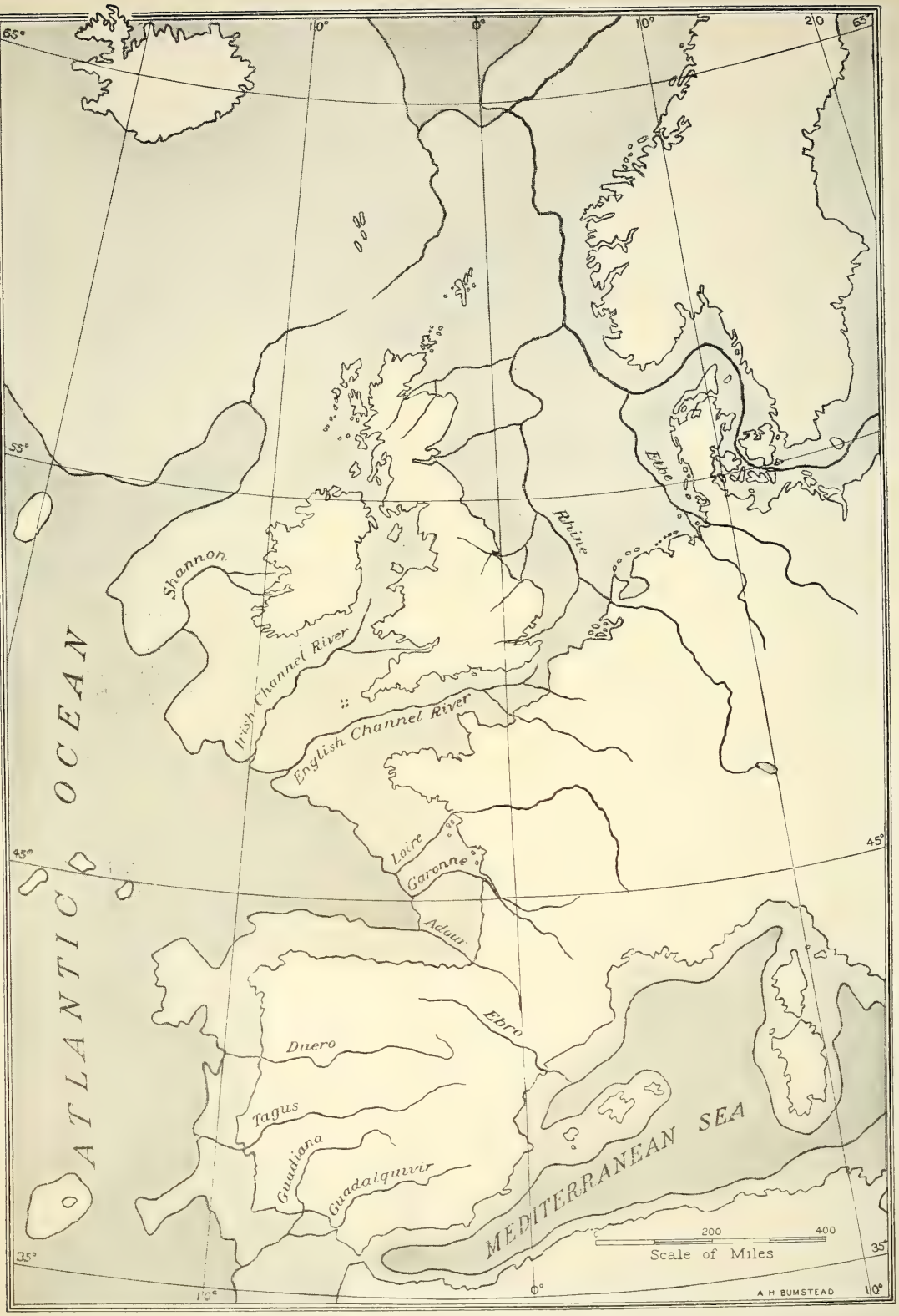
for either beasts or men. Both the human and the brute inhabitants migrated thither in great waves from Asia and from Africa, in the latter case it being probable that the source of the migratory wave was also in Asia, north Africa being merely the route of passage for the majority of the forms.

Very few mammalian forms trace their origin to Europe in the sense that others, such as horses, camels, anthropoid apes, hippopotamuses, ant-eaters, elephants, kangaroos, trace their several origins to North America, Asia, Africa, South America, and Australia. But a number of the phylæ received their special development in Europe, and this has been notably the case with certain forms of man.

The view held by some writers, that northern (including especially northwestern and north central) Europe was the special center of dispersal for vigorous and dominant life types which overran the world, is without foundation in fact. Again and again within comparatively recent geologic times northern Europe has been almost denuded of life. Only for short periods has it been a center of dispersal, and even during these periods it has merely dispersed types, perhaps developed types, of creatures which in the normal course of events it has been receiving as dominant migrants and invaders from other regions.

This is as true of the "Nordic Man" who overran southern Europe fifteen hundred years ago as of his mixed-blood successors who during the last five centuries have on a larger scale overrun most of the earth, and of the parasitic companions of these mixed-blood successors, such as the rat, the rabbit, the house sparrow, and various weeds.

The great cultures and great cultive races of Europe in prehistoric times came from elsewhere, doubtless Asia. The men who used metals, who owned flocks and herds, and who grew crops—that is, the men out of whom it was possible to



WESTERN EUROPE DURING THE THIRD INTER-GLACIAL STAGE

In which Africa, the British Isles, and Iceland were connected with the mainland and the river channels were much extended. During this period the Piltdown man (see page 119) was living in England and France.

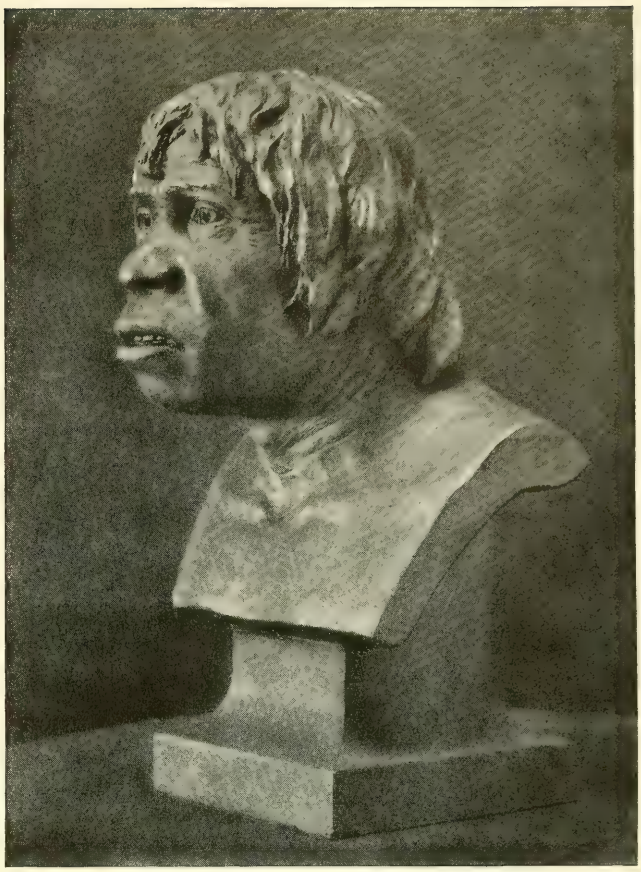
develop modern civilization—were all immigrants in Europe, who had originated and started upward elsewhere.

THE ONLY RECORDS OF EARLY MAN YET DISCOVERED ARE IN EUROPE

But while we could doubtless learn far more of the paleo-history and prehistory of man if we knew what had happened to him in Asia during the two or three hundred thousand years before history dawned in Mesopotamia and on the Nile, we do not, as a matter of fact, possess such knowledge. The records are European, as already said, and necessarily in our studies we must deal chiefly with Europe.

The climatic changes in both temperature and moisture produced extraordinary oscillations in the giant mammalian fauna of the time.

At the close of Pliocene times Europe possessed a warmer climate than at present, and in the forests flourished many trees now only known in America—the sequoia, sabal, sassafras, locust, sweet-gum, and tulip tree. There is no evidence that any ancestor of man then existed in Europe; but elephants, rhinoceroses, hippopotami, saber-tooth tigers, wild oxen, and horses abounded.



Photograph from Osborn's "Men of The Old Stone Age"

A HEAD RECONSTRUCTED ON THE PILTDOWN SKULL, FOUND IN SUSSEX, ENGLAND: EOANTHROPUS DAWSONI

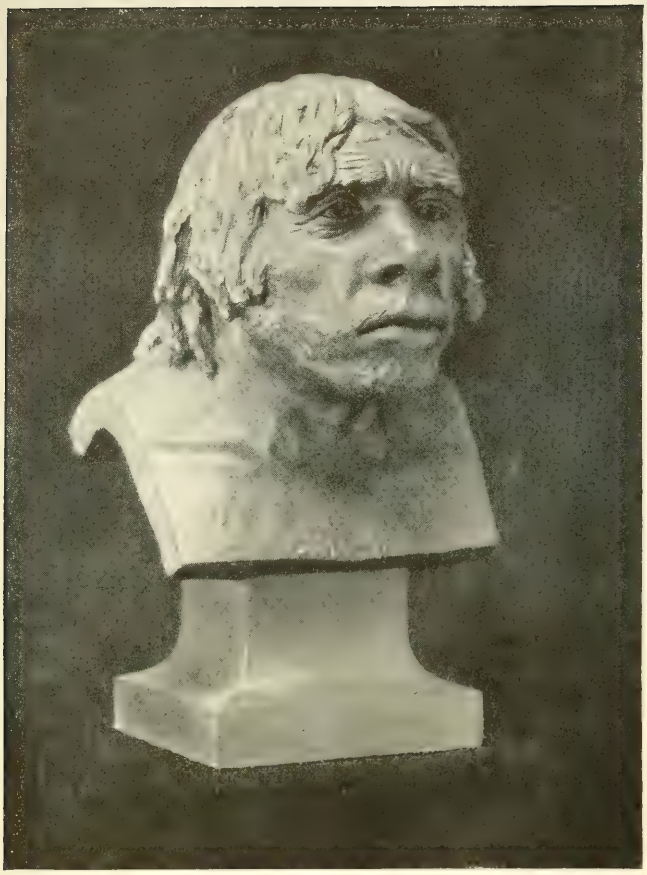
The race is believed to have lived in England and France 100,000 to 300,000 years ago (see page 123)

The period of glaciation which ushered in the Pleistocene drove these animals southward, or into restricted areas in middle Europe, and brought in many northern forms, such as the musk-ox. In the long succeeding period of mild climate elephants and hippopotamus lived beside or near by moose and lions and Irish elk, and the saber-tooth was the chief beast of prey (see page 117).

Then came the second and severest period of glaciation. During the mild inter-Glacial period which followed new species of elephants and rhinos appeared, and also the lion and hyena, together with various species of horses, deer, and cattle. Most important of all, the Heidelberg man appeared — the earliest true man, clearly human, but, equally clearly, closer kin to his remote anthropoid kinfolk than is any existing savage.

Again the glaciers advanced, and the mammoth and woolly rhinos (see page 116) appeared, but disappeared as the third inter-Glacial period of mild climate set in. During this third period primitive types of men existed side by side with the great southern faunas.

Once more the ice closed down; mammoth, woolly rhinoceros, musk-ox, and reindeer advanced southward from the



Photograph from Osborn's "Men of The Old Stone Age"

THE NEANDERTHAL MAN, A RACE WHICH LIVED IN CAVES OF CENTRAL FRANCE 50,000 YEARS AGO (SEE PAGES 123-125)

Modeled on skull from cave of La-Chapelle-aux-Saints: Corrèze, France

Arctic tundra, and sometimes mingled with lion and aurochs, horse and giant deer; and the low-browed, almost chinless human hunters of the period dwelt in grottos or at the mouths of caverns, the possession of which they disputed with the cave bear, cave lion, and cave hyena.

As this ice age passed there came a period of cold, dry climate, and with it an invasion of animal life from the eastern steppes—the kiang, the saiga, the jerboa, and the steppe horse. Then by degrees the climatic and geographical conditions changed to those that still obtain—the beasts of the steppes retreated eastward and those of the tundra northward, and the giant forms vanished from the earth.

THE APE-MAN OF JAVA

It is the people who were the companions of these successive faunas whom Mr. Osborn describes. He begins by a brief summary of the probable ancestral tree of man in his prehuman days, showing that his stem probably branched off from that of the anthropoid apes at the beginning of the Miocene, having split from the monkey stem at or before the beginning of the Oligocene. Then he discusses the famous ape-man of Java, the pithecanthropus, the prehuman creature — probably, however, only collaterally in our line of ancestry—who appeared at the dawn of the Pleistocene (see picture, p. 112).

This being was already half way upward from the beast, half way between true man and those Miocene ancestors of his, who were still on the psychic and intellectual level of their diverging kinsfolk, the anthropoid apes. He, or some creature like him, was in our own line of ascent during these uncounted ages when our ancestors were already different from all other brutes and yet had not grown to be really men. He probably used a club or stone at need; and about this time he may have begun very rudely to chip or otherwise fashion stones to his use.

His progress was very, very slow; the marked feature in the progress of man has been its great acceleration of rapidity in each successive stage, accompanied continually by an inexplicable halt or dying out in race after race and culture after culture.

250,000 YEARS LATER—THE HEIDELBERG MAN

After the ape-man of Java we skip a quarter of a million years or so—according to Mr. Osborn's conservative figur-

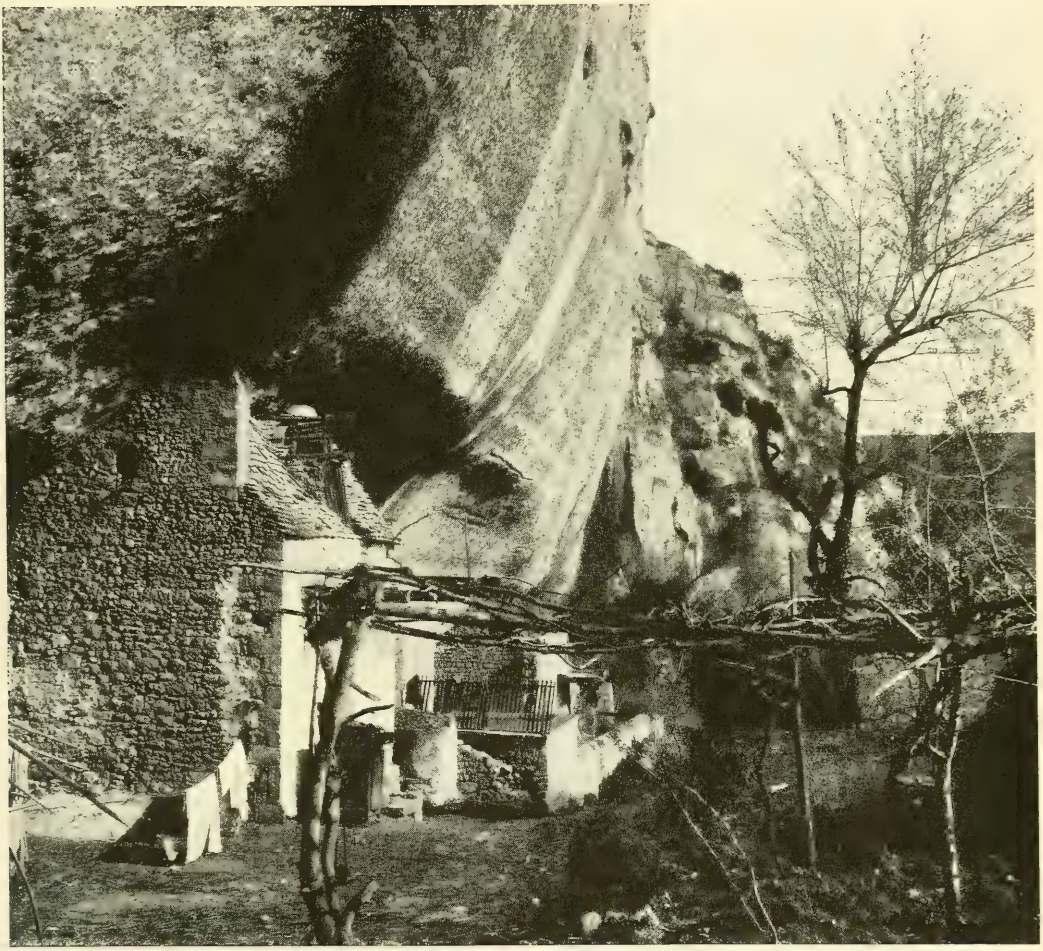
Photograph from American Museum of Natural History

IN THE CAVES OF THESE AND SIMILAR CLIFFS IN CENTRAL FRANCE THE NEANDERTHAL RACE OF MEN LIVED FOR 50,000 YEARS: VALLEY OF THE VÉZÈRE, FRANCE
(SEE PAGE 125)

Photographs from Osborn's "Men of The Old Stone Age"

HEAD OF THE "OLD MAN OF CRÔ-MAGNON"

Rejuvenated by the restoration of the teeth, showing the method of restoration of the features adopted in all the models by J. H. McGregor. The diameter of the head across the cheek bones is seen to be greater than that across the cranium. "The most profound change in the whole racial (not cultural) history of western Europe was the sudden and total supplanting of these savages, lower than any existing human type, by the tall, finely built Crô-Magnon race of hunters, who in intelligence evidently ranked high as compared with all but the very foremost modern peoples, and who belonged to the same species of man that we do—*Homo sapiens*" (see text, page 125),



Photograph from Osborn's "Men of The Old Stone Age"

UNDER THE SHELTER OF THESE ROCKS WAS FOUND A SKELETON OF THE CRÔ-MAGNON RACE OF HUNTER-ARTISTS WHO ENTERED EUROPE 13,000 YEARS AGO

ing—before we get our next glimpse of a near-human predecessor of ours. This is the Heidelberg man, who lived in the warm second interglacial period referred to above, surrounded by a fauna of huge or fearsome beasts, which included the saber-tooth and the hippopotamus, and also rhinoceroses and elephants of southern type.

He was a chinless being, whose jaw was still so primitive that it must have made his speech imperfect; and he was so much lower than any existing savage as to be at least specifically distinct—that is, he can be called "human" only if the word is used with a certain largeness.

Again we make a long skip—this time of somewhat over a hundred thousand years—and come to the Piltdown man, or near-man—a being seemingly little farther advanced than the man of Heidelberg, and in some ways less so, for he possessed apelike canine teeth. As regards all of these very early near-human remains, there is room for considerable difference of opinion not only as to their exact relationships and their standing on the man-phylum, but as to their age, both absolutely, and relatively to other human remains and to the remains of the great Pleistocene faunas (see picture, p. 119).

A RACE THAT WAS CONTENT TO LIVE IN CAVES FOR FIFTY THOUSAND YEARS

The next race was that of the Neanderthal men, much more modern and

AN ILLUSTRATION OF THE MAN OF 50,000 YEARS AGO

"These Neanderthal men were squat, burly, big-headed, thick-skulled savages, with brows projecting over cavernous eyes, knees permanently bent, and jaws almost chinless. Their brains were of good size, but the portions which represent the higher intellectual attainments were poorly developed" (see text, page 125).

Photographs from Osborn's "Men of The Old Stone Age"

CRÔ-MAGNON MAN IN THE CAVERN OF FONT-DE-GAUME, DORDOGNE, RESTORED IN THE ACT OF DRAWING THE OUTLINES OF ONE OF THE BISONS ON THE WALL

more advanced, but lower than any existing savage, and specifically distinct from modern man. This race dwelt in Europe, without other human rivals, for an immense period of time; probably at least fifty thousand years; certainly an age several times as long as the period included in the interval between the earliest polished stone men and ourselves—in other words, several times as long as the ages of polished stone, bronze, and iron and the total of historic times all put together (see picture, page 120).

These Neanderthal men were squat, burly, big-headed, thick-skulled savages, with brows projecting over cavernous eyes, knees permanently bent, and jaws almost chinless. Their brains were of good size, but the portions which represent the higher intellectual attainments were poorly developed.

The type skull of the race was discovered sixty years ago; but its wide divergence from existing type, combined with its large brain capacity, caused students to doubt its exact place in the human scale. Darwin practically ignored it, although it was exactly the "missing link" he hoped to find. The perverse ingenuity of the great anatomist Virchow, who, with wrong-headed insistence, declared its peculiarities to be pathologic, delayed for a generation the full understanding of its importance.

Other skulls and skeletons were found, however, and there is now no more doubt of the racial existence of the Neanderthals than of the racial existence of the ancient Egyptians. They were a low race of men, distinctly human, but far nearer the beast than any existing race. They were widely distributed, began to live in caves when the Glacial epoch really opened, and assiduously practiced the industry of making tools, implements, and weapons of flint.

They lived by the chase of the great game with which they were surrounded. Some of their favorite hunting grounds were frequented by them for untold generations, and the skeletal remains of thousands of bison and reindeer and tens of thousands of wild horses, mingled with the bones of mammoth and rhinoceros, show how the game abounded.

Some of their favorite caverns were lived in by them and by their successors for fifty thousand years.

They were widely, although thinly, spread over Europe, and the development of their flint tools and implements is everywhere so uniform as to show that the various stages in the evolution of their culture in different places were essentially contemporary. During the immense period of time when they were the only human beings in Europe the climate changed from warm-temperate to glacial, and the fauna changed in like fashion, one set of beasts supplanting another. They hunted all these creatures, but especially the horses, oxen, and reindeer.

Yet how small a factor man then was as regards the extermination of the big game may be gathered from the fact that the changes in the faunas were evidently due purely to climatic alterations. When the climate changed, so as to favor the mammoth, woolly rhinoceros, musk-ox, reindeer, and steppe horse, they all swarmed into the land, where hitherto they had not been found, and flourished and increased greatly. It is evident that the presence of the Neanderthal hunter had no effect upon them. He could not even prevent their increase when climatic conditions favored such increase.

OUR ANCESTORS, A RACE OF TALL HUNTER-ARTISTS, ENTER EUROPE

At last the life term of these primitive hunter folk drew to a close. They were not our ancestors. With our present knowledge, it seems probable that they were exterminated as completely from Europe as in our own day the Tasmanians were exterminated from Tasmania.

The most profound change in the whole racial (not cultural) history of western Europe was the sudden and total supplanting of these savages, lower than any existing human type, by the tall, finely built Crô-Magnon race of hunters, who in intelligence evidently ranked high as compared with all but the very foremost modern peoples, and who belonged to the same species of man that we do—*Homo sapiens* (see picture, page 122).

Geologically, these were modern immigrants into western Europe; for there

is reasonably good ground to believe that they entered that region only twenty-five or thirty thousand years ago. They possessed really noteworthy artistic ability, and their carvings, drawings, and paintings of the mammoth, bison, aurochs, rhinoceros, horse, reindeer, cave bear, and cave lion are of high merit.

THE WHITE MAN HAS NOT BEEN AN IMPORTANT ELEMENT IN HISTORY FOR MUCH MORE THAN 3,000 YEARS

One or more Asiatic races reached central Europe somewhere about this time and may have influenced their culture. For a time there was another race associated with them in southern Europe, and, very curiously, this was a race akin to the negro pygmies of present-day Africa.

But these small negroids soon vanished, and the tall hunter-artists remained the sole masters of western Europe for what, judged by all historic standards, was an immense period of time—perhaps ten thousand years—certainly much longer than the period which covers the entire known history of the white race which now dominates the world—for the European white man has not been a ponderable element in civilization or history for much more than three thousand years.

Then the Crô-Magnons in their turn succumbed. There are indications that they had already begun to fall off somewhat, both physically and culturally, in accordance with that strange law which seems to apply to every social and political organism, just as it does to every individual, and which ordains that growth shall be followed by decay and death.

Be this as it may, this fine race disappeared, almost or quite completely, and in its place there came, seemingly from Asia, four or five different types of humanity, all of which can today be discerned in Europe's ethnically very mixed population.

The extreme difficulty of determining in prehistoric times the extent of correlation between racial invasion and cultural change and the effect upon one race of conquest or infiltration by another may be measured by comparing it with what we know of these matters in connection with the comparatively modern and historic case of the Normans.

These were Scandinavian sea-thieves, who conquered and settled in a province of France to which they gave their name, the name being merely the romance-speaking peoples' effort to pronounce Northmen, as both Norwegians and Danes were often called. In its early stages the conquest was precisely like those which other Norsemen made in England, Scotland, and Ireland. In these countries the invaders were ultimately assimilated with the original inhabitants and became Englishmen, Irishmen, and Scotchmen without producing any new racial type.

But the conquerors of the province in northwestern France so influenced and were so influenced by their surroundings, including especially the people they conquered, that an entirely new and extraordinary race sprang up—a race that for a century or two was, on the whole, the leading force in the development of western Europe. This race lost almost every particle of its Scandinavian culture—speech, religion, art, weapons, industry, law. It became completely French in all these matters, and doubtless mainly French even in blood.

But it produced a totally new and exceedingly able and formidable type of Frenchman. Normans conquered Sicily, England, and Ireland, putting rulers on the thrones of the two former, and established earldoms or principalities in places as far apart as Scotland and Syria. Everywhere they merged in the mass of the people whom they had conquered and dominated. Everywhere their advent produced a profound and lasting effect on the culture of the conquered people, and yet nowhere did they leave a trace of the culture of their own forefathers, and they left only a trace of their blood.

If we had not the written records we would be utterly unable to make a guess at the causes of the revolutions and totally new types of evolutionary development in civilization which they brought about. The merest glance at their history explains why we find so many prehistoric problems insoluble.

EUROPE DID NOT GIVE RISE TO A SINGLE SPECIES OF MAN

Mr. Osborn's conclusions are stated tentatively — that is, scientifically — as strong probabilities, not certainties. They are as follows, and they represent the conclusions which are in accord with our present knowledge.

From the earliest Paleolithic to Neolithic times western Europe was never a center of human evolution. It did not give rise to a single species of man, nor did there occur therein any marked evolution or transformation of human types. The main racial evolution took place to the eastward, whence at first primitive and afterward modern types of men found their way westward.

Of all the races of Paleolithic man which appeared in Europe, no one was ancestral to any other; they all successively arrived fully formed. Therefore the family trees or lines of descent of the races of the Old Stone Age consist of a number of entirely separate branches, which had been completely developed in the eastern mass of the great Eurasiatic continent.

The sudden appearance in Europe, some 25,000 years ago, of a human race with a high order of brain was not a local leap forward, but the result of a long process of evolution elsewhere. Throughout the whole period there was a long, slow process of checkered progress, marked by the rise and fall of races, of cultures, and of industries. It is a fascinating subject, and no one has dealt with it as ably as Mr. Osborn.

THE CRADLE OF CIVILIZATION

The Historic Lands Along the Euphrates and Tigris Rivers Where Briton Is Fighting Turk

By James Baikie

Author of "Sea Kings of Crete" and "The Resurrection of Ancient Egypt" in the National Geographic Magazine

IN THE southwestern corner of the great continent of Asia, between the Persian Gulf and the border of that great elbow known as Asia Minor, which the continent thrusts out westward, there lies a land whose influence upon the history of the human race it would scarcely be possible to overestimate.

This is the place which is generally recognized to have been the original home of the human race, where, in dim and misty ages before history began, men first attempted to form themselves into organized communities, where the Hebrew race found its origin, and whence their first leader, Abraham, went out in search of the land which he should afterward receive for an inheritance.

It is a long and comparatively narrow stretch of country, running up from the Persian Gulf toward the Taurus Mountains and that lofty tableland which we now know as Armenia. On its northern and northeastern side it is bordered by a fringe of mountains, gradually sloping up toward the great northern ranges. On the southern and southwestern side it fades away into the great Arabian desert (see map, page 216).

SOURCE OF MESOPOTAMIA'S FERTILITY

Far up in the tableland of Armenia, about 800 miles in a straight line from the gulf, rise two great rivers—the Tigris and the Euphrates. The former breaks through the mountain wall of the tableland on its eastern flank and flows in a southeasterly direction throughout almost its entire course.

The latter breaks through on the western flank and flows at first westward, as though making for the Mediterranean. It then turns south and flows directly southward for awhile; then sweeps around in a great bend to the southeast

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THE GARDEN OF EDEN

"The Garden of Eden is described in a way that leaves the actual situation which the writer was aiming to indicate very vague, but certainly it is in the neighborhood of the Euphrates, which is definitely named as one of the rivers which water it; and the word 'Eden' itself is the ordinary term for a plain in the Sumerian speech, the oldest language existing in this region. So that the Garden of Eden simply meant the Garden of the Plain, and the first forefathers of our race were believed to have had their home in this most fertile spot" (see page 132).

and follows a course gradually converging upon that of its sister stream. Finally, near the sea, the two unite and issue as one river into the Persian Gulf.

The land traversed by these two rivers has, like the sister river-land of Egypt, been from time immemorial one of the great historic centers of human development. It divides into two portions of fairly equal length. For the first 400 miles the country gradually descends in a gentle slope from the mountains, forming an irregular triangle between the two rivers, within which the land becomes less and less hilly, as it sinks southward, till, as it nears the Euphrates, it becomes a broad steppe, which, beyond the river, rolls off into the desert. This portion is strictly the land called by the Greeks "Mesopotamia."

THE GREAT ALLUVIAL PLAIN

The second division is totally different in character. It is simply a great delta, like that of the Nile—a flat, alluvial plain, which has been entirely formed of the silt brought down from the mountains by the two great rivers.

The process of land-making is still going on, and the waters of the Persian Gulf are being pushed back at the rate of about 72 feet per annum. What this slow process may achieve in many centuries is evidenced by the fact that we know that the ancient town of Eridu was still, at about 3000 B. C., an important seaport on the Persian Gulf. It is now 125 miles from the sea.

Both lands were entirely dependent for their habitability and fertility on the rivers which traversed them. In Mesopotamia the Tigris and the Euphrates have for long stretches channeled deep into the soil and flow below the level of the land. In the lower district—Babylonia—the ordinary level of the rivers is frequently above that of the surrounding plain; so that inundations are of frequent occurrence, and large tracts of the country are now unhealthy marshland.

In both cases, therefore, though for opposite reasons, the hand of man was needed to make the rivers helpful. In Mesopotamia the water was controlled by dikes and dams, which held it up until it was raised to the level of the land, over which it was then distributed by canals. In Babylonia the surplus water was drawn off directly by a great canal system, the banks of whose ancient arteries still stretch in formidable ridges across the plain.

FLOWING WITH MILK AND HONEY

Under the system of irrigation both lands were astonishingly fertile. Even today it can be seen that only well-directed work is needed to bring back the ancient fertility. After the spring rains the Mesopotamian slopes are clothed with rich verdure and are gay with flowers. But of old these lands were the wonder of the world for their richness.

Of Babylonia the Greek historian Herodotus wrote 2,350 years ago: "This territory is of all that we know the best by far for producing grain; as to trees, it does not even attempt to bear them, either fig or vine or olive; but for producing grain it is so good that it returns as much as two hundred fold for the average, and when it bears at its best, it produces three hundred fold."

You had, then, a land which, in constant human occupation and with constant and organized attention to the details of irrigation, was capable of almost anything; but at the same time it was a land which, left to itself, went back quickly to wilderness. The parching heat of summer withered everything on the Mesopotamian uplands; the low levels of Babylonia very speediiy became marsh if the waters were not regulated.

So, the hand of man being withdrawn or checked, both Mesopotamia and Babylonia went back to the state in which they were originally and in which we see them now. They became great barren wastes, the Mesopotamian slopes clad in spring with a brief beauty, then parched and desolate for the rest of the season; the Babylonian plains covered with swamp and jungle, where fever and malaria breed continually.

DESOLATION SUCCEEDS LUXURIANCE

The desolation is only accentuated by the melancholy remains of human activity—canals choked and silted up till they have become fever beds instead of arteries; huge mounds of rubbish which once

were great historic cities, towering up above the plain, shapeless and unsightly.

Before man came the land was waste. When he had learned to bridle its rivers and to develop its capabilities, it became "as the garden of the Lord." Now that he has lost the grip of his first inheritance it has gone back to waste again.

Yet there can be no doubt that here is a country of almost infinite possibilities, and that in the future, possibly not a very distant future, the first home of the race will again be one of the most fertile and perhaps one of the busiest spots in the world.

BIBLE WRITERS AS EYE-WITNESSES

There are few things more remarkable than the way in which this land which had once been supreme in the history of the world, and which for centuries was one of the great molding forces of human story, passed almost entirely out of the thought and memory of civilized man.

We know it, of course, from our Bibles. The name of Nineveh, "that great city," and the story of Nebuchadnezzar's pride, as he looked round upon palace and temple and tower, and said: "Is not this great Babylon, which I have built?" These things are part of our earliest and unforgettable impressions of history.

The men who wrote the history and the prophecy of the Old Testament did so when these lands were living and at the height of their glory. They witnessed Assyria trampling down the nations and gathering their treasure "as one gathereth eggs that are forsaken," and they saw her fall, exulting over the overthrow of Nineveh, whose cruelty had passed upon all nations. They saw the second rise of Babylon under Nebuchadnezzar, and lived in the midst of its splendors and beheld them all pass away.

"THEN CAME MIDNIGHT"

Then came down midnight. So utterly had the local habitation and the name of these great cities vanished from the memory of man that 400 years before Christ, when Xenophon and the Ten Thousand marched through the land after the battle of Cunaxa, they passed the ruins of Nineveh and never knew of them, and encamped beside the ruins of Kalah, another of the mighty cities of Assyria, and spoke of them as "an ancient city named Larissa."

Wonderful stories and legends, of course, still found their place in the minds of men about these ancient cities and monarchies—legends of Nimrod, of Ninus and Semiramis, and of the wonderful palaces and hanging gardens of Babylon. But where these cities stood and what had become of their glories, these were things utterly forgotten for close on 2,000 years.

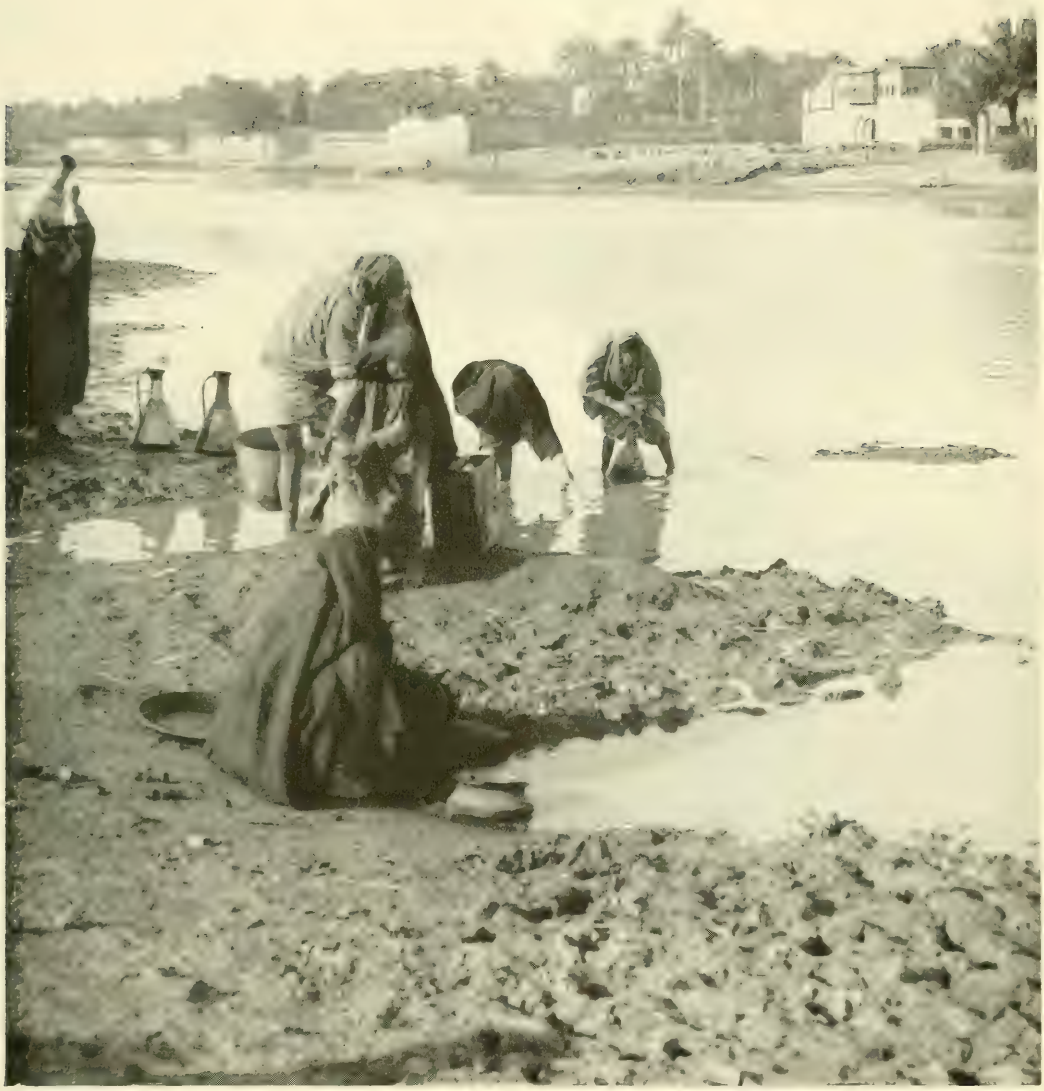
"Babylon," said Isaiah, long before (Isaiah xiii: 19-22), "the glory of kingdoms, the beauty of the Chaldee's excellency, shall be as when God overthrew Sodom and Gomorrah. It shall never be inhabited, neither shall it be dwelt in from generation to generation, neither shall the Arabian pitch tent there. . . . But the wild beasts of the desert shall lie there, and their houses shall be full of doleful creatures; and owls shall dwell there, and satyrs shall dance there."

THE WORDS OF A PROPHET

And Zephaniah (ii: 14) writes thus of the sister city, whose fall was earlier: "He will make Nineveh a desolation, and dry like the wilderness. The cormorant and the bittern shall lodge in the upper lintels of it. . . . This is the rejoicing city that dwelt carelessly, that said in her heart, I am, and there is none beside me; how is she become a desolation, a place for beasts to lie down in; every one that passeth by her shall hiss and wag his hand."

Layard thus describes the emotions excited by the first contemplation of the desolate heaps which now represent the cities of Mesopotamia. After speaking of "the stern shapeless mound rising like a hill from the scorched plain, the fragments of pottery, and the stupendous mass of brickwork occasionally laid bare by the winter rains," he goes on:

"He is now at a loss to give any form to the rude heaps on which he is gazing. Those of whose works they are the remains, unlike the Roman and the Greek, have left no visible traces of their civilization or their arts; their influence has long since passed away. The scene around is worthy of the ruin he is con-



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A PICTURESQUE SCENE ON THE EUPHRATES BELOW BABYLON

Babylonia is a great delta like that of the Nile—a flat alluvial plain which has been entirely formed by the silt brought down by the great Tigris and Euphrates rivers. The process of land-making is still going on, and the waters of the Persian Gulf are being pushed back at the rate of about 72 feet per annum. What this slow process may achieve in many centuries is evidenced by the fact that we know that the ancient town of Eridu was still, at about 3000 B. C., an important seaport on the Persian Gulf. It is now 125 miles from the sea (see page 129).

templating; desolation meets desolation; a feeling of awe succeeds to wonder; for there is nothing to relieve the mind, to lead to hope, or to tell of what has gone by. These huge mounds of Assyria made a deeper impression upon me, gave rise to more serious thoughts and more earnest reflection than the temples of Baalbec, and the theaters of Ionia."

DARKNESS OF CENTURIES BROKEN

The darkness of centuries has since been broken, and broken mainly, in the first instance, by the man who wrote these sentences. Let us therefore seek to outline what we have gradually come to know of the earliest story of the human race in these lands, which seems, as far as can be judged, to be possibly the earliest story of the human race in the world—that is to say, as civilized and organized beings.

Scripture, of course, places the first beginnings of human story in this land. The Garden of Eden is described in a way that leaves the actual situation which the writer was aiming to indicate very vague; but certainly it is in the neighborhood of the Euphrates, which is definitely named as one of the rivers which water it; and the word "Eden" itself is the ordinary term for a plain in the Sumerian speech, the oldest language existing in this region.

THE GARDEN OF THE PLAIN

So the Garden of Eden simply meant the Garden of the Plain, and the first forefathers of our race were believed to have had their home in this most fertile spot. The story of the Deluge moves in the same region, and the Babylonian records preserve a tradition which corresponds almost detail for detail with that of Noah and the Ark.

In Genesis xi we have the Hebrew tradition of the beginnings of organized civilization, with the rise of the first city, and the origin of the strifes and jealousies which have separated the various nations from one another. It is, of course, poetically described, but the place where these beginnings occurred and the methods adopted by these earliest organizers of the race are stated with perfect clearness, and they correspond exactly with the conditions existing in Babylonia.

"It came to pass, as they journeyed from the east, that they found a plain in the land of Shinar; and they dwelt there. And they said one to another, 'Go to, let us make brick, and burn them thoroughly.' And they had brick for stone, and slime had they for mortar. And they said, 'Go to, let us build a city and a tower whose top may reach unto heaven; and let us make us a name, lest we be scattered abroad upon the face of the whole earth.' "

Here we have the terse and vivid statement of what must necessarily have happened when men first began to realize their powers and to organize themselves in such a land. The writer of Genesis puts in two sentences, as if it were a single act, what no doubt, in actual fact, took hundreds or perhaps thousands of years to attain.

But there and in that fashion there is no doubt that cities took their rise and civilization began to develop. The fertile plain invited habitation. Men felt the need of gathering for mutual protection against their human enemies or the wild beasts which abounded; and when they cast about as to how to build they found themselves faced by the fact that Babylonia produces no building stone.

Their buildings had to be reared of the mud of which their land was composed; and, from the dawn of history to its close, buildings in Babylonia were of brick, huge masses of crude sun-dried mud, cased on the outside only with the harder kiln-burned bricks.

A CITY FOR PROTECTION AND A TOWER FOR WORSHIP

"A city and a tower," says the writer, and again he is true to the facts. The city for protection and the tower for worship. For the characteristic feature of Babylonian temple architecture, distinguishing it sharply from the Egyptian temples, with their succession of chambers on the ground level, is the "Ziggurat," or temple tower, rising in successive stages, each stage a little less in area than the one beneath it, until the shrine on the summit is reached.

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IRRIGATION ON THE EUPHRATES, WHERE MEN HAVE TOILED SINCE ADAM LEFT EDEN

The science of irrigation was developed on the banks of this river many thousands of years ago. Babylonia was then one vast network of canals. Around the whole country spread a Chinese wall inverted, a great moat, water-filled, at once to keep out the alien stranger and to fill up the network of canals. At the same time these larger canals furnished natural highways of commerce, and thousands of boats plied their waters. One of them left the Euphrates from the right bank near Hit and skirted the plain all the way to the Persian Gulf. The work was so well done that even the debris of thirty centuries has not been able to obliterate it. No one can say how long ago it was built, but we do know that it was ancient in the days of Nebuchadnezzar—so ancient that he "pointed with pride" to the fact that he had cleaned it out once more and restored it. Not a hundredth part of what is still left visible of the ruined irrigation works is in use today. Where once as fine crops as ever grew flourished in luxuriance, there is desert and marsh and the silent mounds of entombed cities.

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THE MOUND COVERING THE REMAINS OF UR OF THE CHALDEES

Ur of the Chaldees is best known as the place out of which came the patriarch Abraham. When we first meet the Babylonians, some four thousand years before Christ, they were already a civilized, metal-using people, living in great cities, possessed of a complicated system of writing, and governed under firmly established civil and religious dynasties and hierarchies (see page 135).

When, then, did this first gathering of human beings into organized communities take place, and what was the race which took this momentous step? As to the question of when, we are hopelessly ignorant. Berosus, the old historian of Babylonia, tells us of kings before the Deluge who reigned for incredible periods — 36,000 years in one instance — while some of his kings after the Deluge come down to comparatively modest spans, such as 2,400 and 2,700 years. It is easy to ridicule such wild fancies, but not so easy to put facts in their place.

Pretty much all that can be said is that somewhere about 4000 B. C. we do seem to get into touch with actual and unmistakable historic facts. That date is at least 1,500 years before the date at which Abraham is believed to have gone forth from the land in search of his inheritance.

But the pioneers had been at work long

before that; for the people whom we meet at 4000 B. C. are already a highly civilized and organized race. Already they had towns of considerable size and importance, each with its own great temple tower rising high above the houses and dedicated to the town god.

LIFE 6,000 YEARS AGO

They had a system of government whose unit was not the kingdom, but the city-state—the city, that is, with as much territory around it as it could conveniently lay hands on and protect from its nearest neighbor, the adjoining city.

At the head of each community was an official who called himself, in his inscriptions, the "patesi," of his own particular state, and who seems to have been, like Melchizedek, a combination of priest and king.

The inhabitants of the city were skilled in various trades and professions; their social fabric was already sharply divided into a considerable variety of classes; and their pottery and the fragments of their sculpture which have survived show us that they were by no means unskilled in the fine arts.

Most important of all, they had already evolved a very complete and highly developed system of writing, which in itself must have taken centuries to reach the stage at which it is first found. It began, no doubt, with pure picture-writing, as the Egyptian hieroglyphic system began; but while the Egyptians maintained the pictorial element of their system to the end, developing alongside of it the hieratic and demotic systems of writing for ordinary purposes, the race in question had already, when we first meet with their writing, got away from any trace of the picture stage. Their writing is already the arrow-headed or cuneiform script which persisted right down to the fall of the great empires of the ancient East (see article by Professor Clay in this number).

WHENCE CAME THE SUMERIANS

The wonderful people who had accomplished all this we call now by the name of Sumerians, from their own name for one of the divisions of their land. Whence they came is unknown.

It has been suggested that they drifted across the mountains from India, and, after settling for awhile in Persia, finally found their resting-place in the Babylonian plain; and that the form which they gave their temples, towering up like mountains into the sky, may have been due to a remembrance of early days among the hills of India and Persia; but that is scarcely more than guesswork.

In fact, we only see this people through the mists for a short time at the very beginning of things, and then they disappear, driven out of their land, or brought into subjection by a stronger and more warlike race—that Semitic people from whom Abraham and the Hebrews sprang.

You are to imagine the land, then, as dotted all over at pretty frequent intervals with fairly important towns. Round each town rises a high wall of brick, very thick and strong, faced on the outside with the harder kiln-burnt bricks. In the center of the town rises the Ziggurat, or temple-tower. It may have any number of stages, from three to seven, according to the wealth of the town or the devoutness of its priest-king. Beside it is the palace of the latter, and under the shadow of these two great buildings crouch the smaller houses.

WANT OF STONE MAKES NARROW ROOMS

Even in the palace the rooms are long and narrow, for the want of stone and timber limits their breadth to the length of such roof-beams as can conveniently be procured; and although the Babylonians had already learned the principle of the arch, they did not vault their buildings save on a small scale.

In the town you would find business thoroughly well organized. Business documents were written in cuneiform script on clay tablets, and when they had been read over, the parties to the contract each signed by pressing his thumb-nail into the wet clay, which was then dried and preserved. Later engraved seals came into use for the purpose of authenticating documents.

Outside the walls lay a ring of fields, some of them private property, some of them common land, but all alike paying tithes to the city-god. Beyond the culti-

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THE TOMB OF EZRA, A SHRINE DEAR TO THE HEART OF INNUMERABLE JEWS

The Tomb of Ezra lies near the junction of the Tigris and the Euphrates, where they flow together and form the Shat-el-Arab. The town of Kut is about half way between Korna and Bagdad, on the Tigris.

vated fields lay the pasture land, which was all held in common. The fields were covered with a network of canals, which distributed the precious river-water, and the whole system of irrigation was carefully regulated and supervised.

KINS-PEOPLE OF THE JEWS

Not much later than 4000 B. C. we find the whole land in the power of the representatives of the same Semitic race which has given us Abraham, Moses, and David, and also Mahomet and Islam. The Semitic rule makes its appearance in the person of an impressive and romantic figure, one of the first of the great founders of world-empires, Shargani-shar-ali, better known as Sargon, King of Akkad.

Fortunately we know, with a fair amount of certainty, when he reigned, for the last king of Babylon, Nabuna'id, states that when he laid bare the foundation-inscription of Naram-Sin, son of Sargon, in the temple of Shamash, at Sippara, he was informed that Naram-Sin had reigned 3,200 years before his time. This fixes Naram-Sin at about 3750 B. C. and Sargon about 3800 B. C., so that he belongs to about the time of the rise of settled government in Egypt.

A GARDENER BECOMES KING

Apparently, like many of the great men of history, he was of humble and obscure birth. The Chronicle of Kish states that "at Akkad, Sharrukin, the gardener, warder of the temple of Zamama, became king." But, whatever his origin, the impression which he made on following ages was great and lasting. When men looked back to the beginnings, they saw the figure of Sargon standing, great and vague, the first man who really counted in their history; and they honored him accordingly.

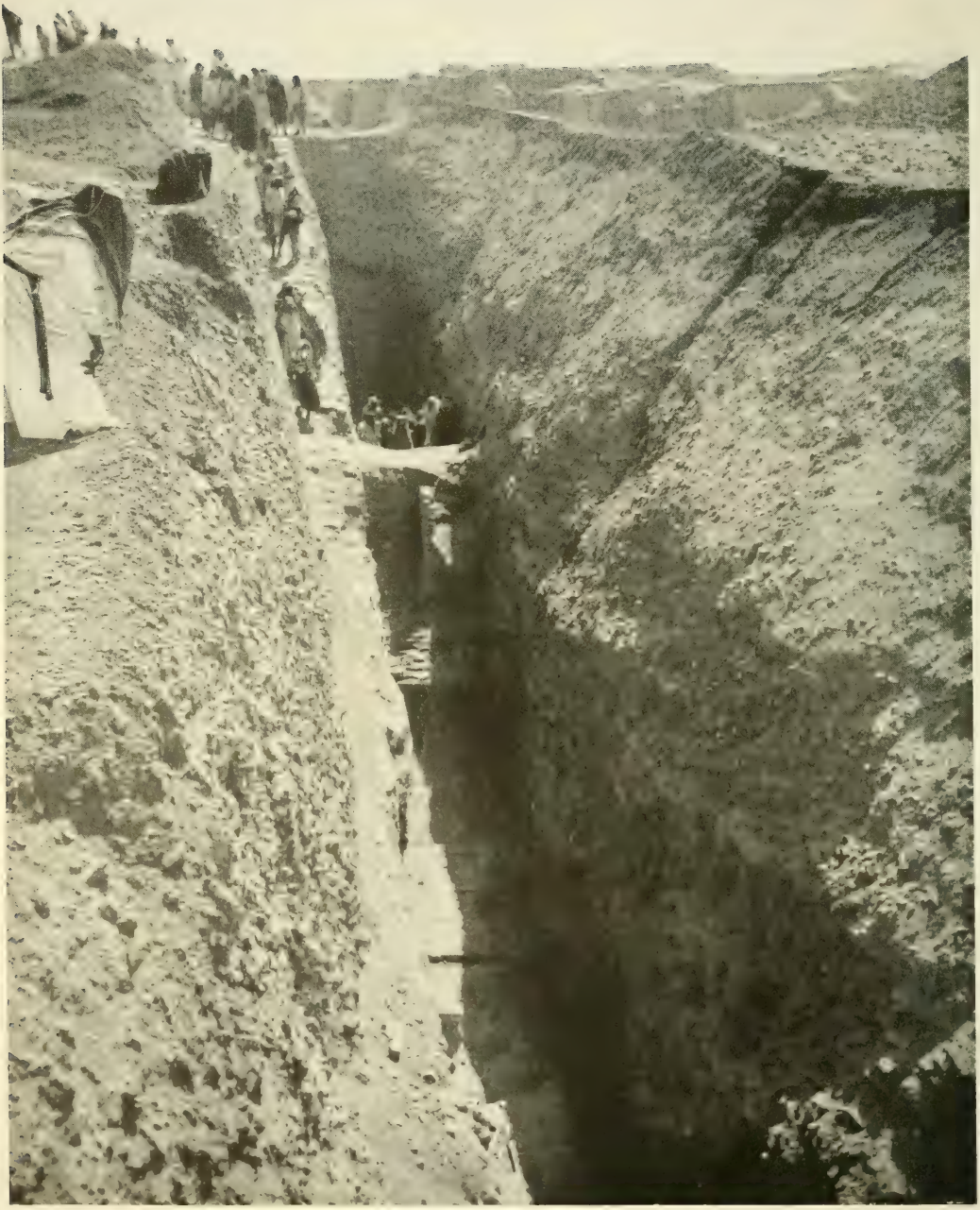
One of the greatest of Assyrian conquerors called himself Sargon also, after this early king, and around the name of the first unifier of the land there grew up a legend which presents a curious parallel to the story of the infancy of Moses. The Assyrian scribes of the eighth century B. C. make him relate the story of his early days, as follows:

"Sargon, the powerful king, King of Akkad, am I.
My mother was of low degree, my father I did not know.
The brother of my father dwelt in the mountain.
My city was Azupirani, situate on the bank of the Euphrates.
My humble mother conceived me; in secret she brought me forth.
She placed me in a basket-boat of rushes; with pitch she closed my door.
She gave me over to the river, which did not rise over me.
The river bore me along; to Akki, the irrigator, it carried me.
Akki, the irrigator, . . . brought me to land.
Akki, the irrigator, reared me as his own son.
Akki, the irrigator, appointed me his gardener.
While I was gardener, Ishtar looked on me with love.
(Forty ?)-four years I ruled the kingdom."

This gardener-king was evidently a man of genius and force. Not only did he unite Babylonia under his rule, but he carried his conquests westward to the Mediterranean, north and east to Armenia and Elam, and south to Arabia and the islands of the Persian Gulf. His doings were held up as the model for all subsequent kings, and if the omens in any reign were the same as those under which the great Sargon of Akkad had gone forth to victory, any king of Babylon or Assyria would march out, confident that success was certain.

About 2300 B. C. there rises another great figure, one of the men who mold human history and keep the world moving onward—a man also who, if some scholars are right, came into close contact with Abraham, and, great as he was, found the contact not at all to his advantage.

In Genesis xiv we read how "Amraphel, King of Shinar; Arioch, King of Ellasar; Chedorlaomer, King of Elam, and Tidal, King of Goiim," made war on the kings of Sodom and Gomorrah, who had rebelled against their overlord Chedorlaomer; how Abraham's nephew, Lot, was captured by them, and how the Patriarch rescued Lot and defeated the invaders. Now these kings may possibly be identified with actual kings of the time. Tidal, King of Goiim, may be Thargal of Gutium; Arioch of Ellasar may be Rim-Sin



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UNEARTHING ANCIENT BABYLON FROM BENEATH THE DÉBRIS OF CENTURIES

Babylonia is covered with cities hidden by the accumulations of thousands of years. And yet never was debris kinder, for it acted as a safe in which treasures of millenniums before Christ could be held in trust for the coming of a generation that would appreciate their value, and that could correctly interpret their meanings. But for the burial from human sight which time gave to the structures and relics of the ancient civilization of the Euphrates and Tigris River country they would have been destroyed, even as the priceless marbles of Rome were destroyed in the manufacture of lime and the magnificent structures of that great city torn down to secure the iron with which the marble blocks were jointed together.

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EXCAVATORS UNEARTHING THE REMAINS OF ANCIENT BABYLON

The citizen of a modern city would probably feel more at home in the Babylon of 5,000 years ago than in medieval Europe. The average Babylonian was no wild savage, but a law-abiding citizen, a faithful husband, good father, kind son, firm friend, industrious trader, or careful man of business. The story of how man came again to know these ancient civilizations, of how we have a more intimate knowledge of the ways of people who lived thousands of years before the Christian era than we have of some who lived so recently as medieval times, constitutes one of the most fascinating passages in the history of exploration.

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A VIEW OF THE RUINS OF BABYLON

"To us the time of Abraham seems almost incredibly distant, and we can scarcely bring ourselves to believe that civilized life was actually possible then; but the Code of Hammurabi is sufficient to assure us that in Babylonia, at all events, life in Abraham's days was practically as thoroughly organized and as carefully regulated as it is in our own" (see page 141).

of Larsam, whose name may also be read Eri-aku; Chedorlaomer is simply Kudur Lagamar, a good Elamite name.

THE FIRST GREAT LAW-GIVER

There remains Amraphel, King of Shinar, who is the most interesting figure of all, if, as seems not unlikely, he is to be identified with Hammurabi, King of Babylon, the first great law-giver of the world whose laws have come down to us. At the time of the invasion of Palestine it seems as though he and the others were vassals of the Elamite Chedorlaomer. Perhaps the defeat sustained at Abraham's hands weakened the Elamite King's authority. At all events we find Hammurabi firmly seated on the throne of Babylon by about 2297 B. C.

Notwithstanding the unfortunate incident with Abraham, he was a great conqueror, subduing the Elamites, and asserting his dominion over the whole of Babylonia and Mesopotamia; but he was far more.

He was one of the first of all kings to understand that a king's glory is to be the father of his people. And so in his inscriptions, while we read of successful wars, we hear far more of canals dug, and temples restored and city walls built, while his favorite titles are "Builder of the Land," and "King of Righteousness."

His great memorial is the famous Code of Laws, of which a copy, engraved on stone, was found by M. de Morgan at Susa and is now in the Louvre. Hammurabi begins his Code with a little bit of self-glorification, perhaps not unwarranted.

"I am the pastor, the saviour, whose sceptre is a right one, the good protecting shadow over my city; in my breast I cherish the inhabitants of Sumer and Akkad. By my genius in peace I have led them, by my wisdom I have directed them, that the strong might not injure the weak, to protect the widow and orphan. . . . By the command of Shamash (the Sun god), the great Judge of Heaven and Earth, let righteousness go forth in the land. . . . Let the oppressed who has a case at law come and stand before my image as King of Righteousness, let him read the inscription, and understand my precious words. The inscribed stone will explain his case to him, and make clear the law to him, and his heart, well pleased, will say, 'Hammurabi is a master, who is as the father who begat his people!' "

LAWS OF HAMMURABI

Then follow 282 sections regulating almost every conceivable incident and relationship of life. Not only are the great crimes dealt with and penalized; life is regulated down to its most minute details.

There are marriage laws and breach of promise laws, laws for the guardianship of the widow and the orphan, irrigation laws, anticipations of modern land legislation, providing that if land is not cultivated the holder must give account and pay compensation, and licensing laws which would rather surprise "the trade" at the present day. "If a wine merchant has allowed riotous characters to assemble in her house, and those riotous characters she has not seized and driven to the palace, *that wine merchant shall be put to death.*"

No such complete regulation of the affairs of human life was known elsewhere in ancient days; nor, indeed, it may be said, till Roman law asserted its power over the world. Of course, it does not follow that the glory of all this legislation belongs to Hammurabi, who, in all probability, was merely the codifier of laws already existing. Still, his honor, even on that footing, is not small, and the revelation which his Code gives us of a well-ordered and highly disciplined community is simply amazing.

To us the time of Abraham seems almost incredibly distant, and we can scarcely bring ourselves to believe that civilized life was actually possible then; but the Code of Hammurabi is sufficient to assure us that in Babylonia, at all events, life in Abraham's days was practically as thoroughly organized and as carefully regulated as it is in our own (see article by Professor Clay in this number).

The great law-giver of Babylonia, Hammurabi, founded an empire which endured through five subsequent reigns, and closed about 200 years after the ad-

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THE CHIEF TEMPLE OF BABYLON, SACRED TO THE NATIONAL GOD, MARDUK

There were hundreds of rooms in this temple. It was known as "the lofty house." A "sacred way" built above the street connected it with the King's palace. Along this the images of the gods and goddesses which constituted the court of Marduk were carried on festive occasions.

vent of its first founder. The steady average length of the reigns speaks of the permanence and stability of the work which had been done by the great and wise man who had united all the wrangling communities of Babylonia into a single strong State.

But no human work can endure forever, and the first empire of Babylonia was no exception to the rule. It suffered the fate common to most early empires. The more highly cultured and advanced and more peaceful people were overwhelmed by the descent of a ruder and more warlike race, who had envied the wealth and prosperity of their neighbors.

The conquering race, in this instance, was one of those wild mountain peoples who occupied the hill country between the Caspian Sea and the Persian Gulf. Finding a footing on the Babylonian plain near the mouth of the rivers, they gradually advanced, until their chief ascended the throne of Babylon and set up a new dynasty. They were called the Kassites, and for over 570 years they ruled over Babylonia, but a Babylonia that was no longer as it had once been, the one great power in the world of the ancient Orient.

A new power, Assyria, had begun to rise above the horizon, and from now onward, with occasional intervals of weakness and decline, this power strides like a Colossus over the whole of the ancient world, terrifying the nations by its remorseless cruelty, and crushing down all opposition and all national aspirations by the ruthless force of one of the most tremendous implements of warfare ever forged by the hand of man.

ASSYRIAN RUTHLESSNESS

With the possible exception of the Huns, or the wild hordes of Tamerlane, there has probably never existed in the history of the world a power so purely and solely destructive, so utterly devoid of the slightest desire to make any real contribution to the welfare of the human race, as Assyria. But the Huns and the hordes of Tamerlane were untaught savages.

In the case of Assyria you have a highly organized and civilized people, skilled to an astounding degree in the arts, with all the power to do great things for humanity, but absolutely deficient in the will.

If you can imagine a man with no small amount of learning, with all the externals of civilization, with a fine taste in certain aspects of art, and a tremendous aptitude for organization and discipline, and then imagine such a man imbued with the ruthless spirit of a Red Indian brave and an absolute delight in witnessing the most ghastly forms of human suffering, you will have a fairly accurate conception of the ordinary Assyrian, king or commoner; the outside, a splendid specimen of highly developed humanity—the inside a mere ravening tiger.

There have been other great conquering races which could be cruel enough on occasion, but at least they contributed something to the sum of human knowledge or achievement. The Roman Empire, for instance, ruthless as were its methods often, was actually a great boon to the world.

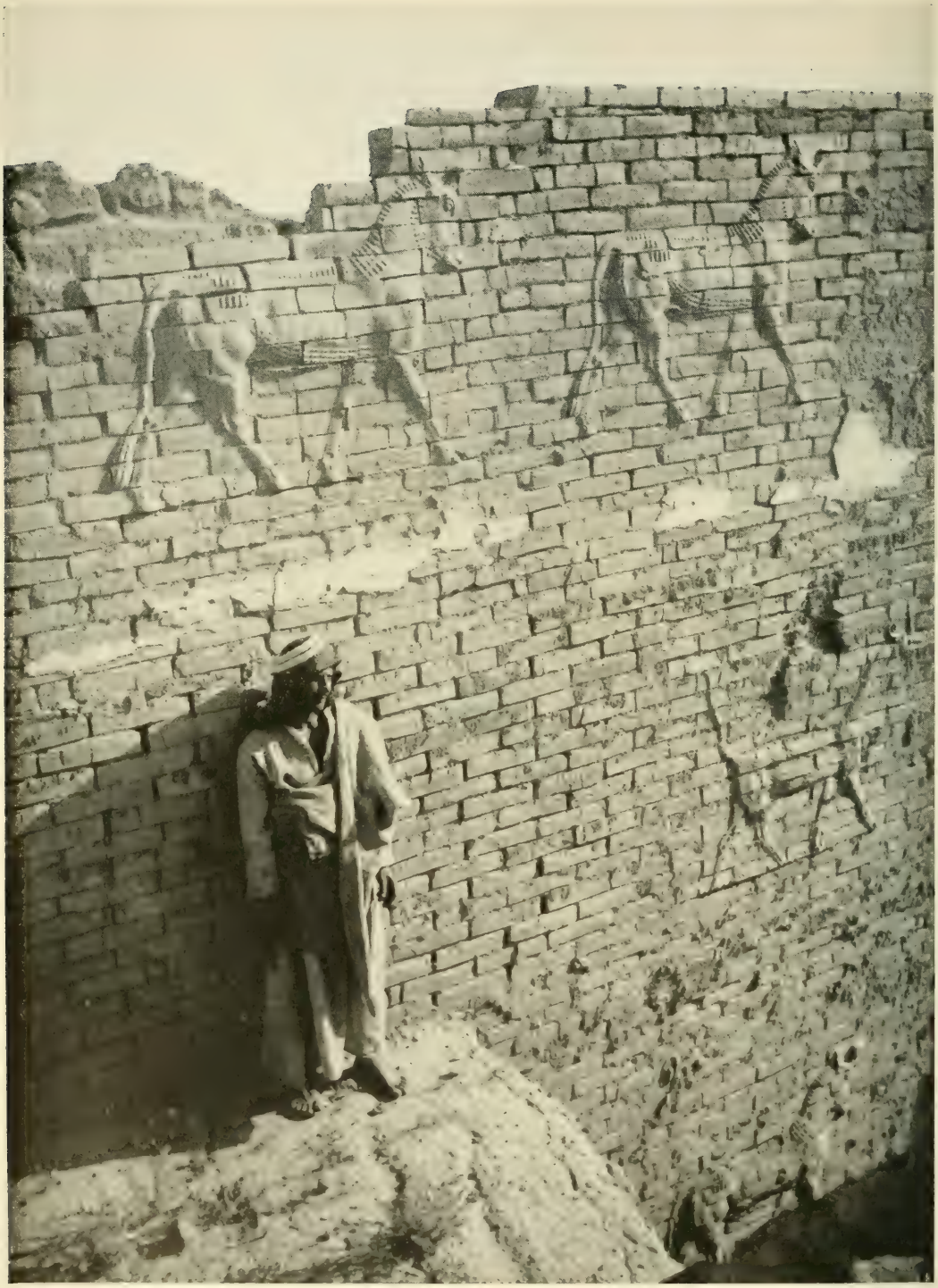
ASSYRIA AN IMITATOR

Assyria made no such contribution to human life. Totally lacking in originality, she took her art, her language, her literature, and her science from the elder Babylonian race upon which she waged such constant war.

She created nothing; she existed simply to destroy; and when she ceased to destroy, she was destroyed. In a word, she was the scourge of God, or, as Isaiah put it, with his vivid insight, her function in the world was just to be God's ax and saw to do the rough hewing that Providence needed for the shaping of the race.

Early in their history the Babylonians seem to have sent a colony northwestward up the rivers into the land of Mesopotamia. There the colonists founded a city which they called Assur, after their god Ashur (see map, page 216). In the time of Hammurabi, Assur was still merely a colony of Babylonia and subject to the empire.

In the less luxurious uplands of Mesopotamia the race had no temptation to degeneracy. Warfare with their wild neighbors from the hills, and warfare



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RELIEFS OF SACRED BULL AND DRAGON ON WALL OF ISHTAR GATE: BABYLON

King Sargon, the gardener king, nearly 6,000 years ago, reviewed his reign much as a President of the United States does his administration in his farewell message. He calls attention to the fact that he restored and colonized ruined cities, that he made tracts of barren lands fertile, that he gave his nation a splendid system of irrigation works, that he protected the needy from want and the weak from oppression, filling the nation's granaries with corn, bringing down the high cost of living, and finding new markets (see page 137).

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THE PROCESSIONAL ROAD TO NEBUCHADNEZZAR'S THRONE HALL: BABYLON

Nebuchadnezzar was the last great warrior that this land produced (see page 157). He lived much nearer to our time than to the time of the gardener-king, Sargon, who is the first Babylonian king of whom we have definite knowledge (see page 137) and who preceded Nebuchadnezzar by 3,200 years.

Photograph from Prof. Albert T. Clay

A 5,000-YEAR-OLD DICTIONARY, IN TWO SECTIONS OF FOUR COLUMNS EACH

The first contains the Sumerian; the second, the character to be explained; the third, the name of the character, and the fourth, the Babylonian, equivalent to the Sumerian in the first. The reader will probably infer that the school boy or girl of 5,000 years ago had a much harder time of it than today. The Sumerians were a wonderful people, who were already civilized when present history begins, 6,000 years ago (see page 135).

even more constant with the wild beasts, the lions and elephants, which abounded in the district, kept them hardy and bold, and welded them together into a people capable of and ready for great achievements should the opportunity arise.

This opportunity came with the Kassite conquest of Babylonia. The familiar rule of their mother-city was broken, and they owed no allegiance, but rather the reverse, to the conquerors. The patesis of Assur threw off the yoke of Babylon, called themselves kings, and established a kingdom (Assyria) which speedily became a formidable rival to the more ancient southern State.

FIVE HUNDRED YEARS OF STRIFE

Five centuries or so ensued, filled with more or less constant strife and bickering between the two States. In the meantime Egypt, under the great soldier Pharaohs of the XVIIIth dynasty, took advantage of the divisions of the only two powers that could have resisted her conquest of all Palestine and Syria, and pushed her empire as far as to the banks of the Euphrates.

In the letters of the time which have been preserved (the Tell-el-Amarna tablets) it is interesting and amusing to see the eagerness with which the kings of Assyria, Babylonia, and Mitanni plead for recognition by the Egyptian Pharaoh, each striving to impress upon the great king the value of his own friendship and the worthlessness of his neighbor's.

Pharaoh of Egypt is the dominating figure of the whole world at this stage, and the kings of the East, whatever their private pride, are, in their public correspondence, his very humble and obedient servants. The balance of power, however, was to be readjusted before long.

There is no need to wade through the dreary story of Assyrian conquest, save where we find it touching upon the Scripture records. King after king repeats, with monotonous reiteration, the story of endless campaigns, all marked by the same ruthless slaughter, the same ghastly cruelty, and the same lack of permanent results. Apparently it was quite impossible for an Assyrian king to be a peaceful sovereign. His State lived by and for the army alone, and if he did not give the army successful employment he was quickly murdered to make way for some one who would lead the troops to conquest and plunder.

A KING REVIEWS HIS REIGN

Take, as a single specimen of an Assyrian conqueror, Ashur-natsir-pal III, whose magnificent palace at Kalah, with its alabaster slabs exquisitely carved in relief, was excavated by Layard in the forties of last century. The slabs are now one of the glories of the British Museum, where also the statue of the great conqueror stands.

We have the record of eighteen years of his reign: there is scarcely a year in which he was not at war; and this is the kind of war he made:

"To the city of Tela I approached. The city was very strong; three fortress-walls surrounded it. The inhabitants trusted to their strong walls and their numerous army; they did not come down or embrace my feet. With battle and slaughter I attacked the city and captured it. Three thousand of their fighting men I slew with the sword; their spoil, their goods, their oxen, and their sheep I carried away; many captives I burned with fire.

"I captured many of their soldiers alive; I cut off the hands and feet of some; of others I cut off the noses, the ears, and the fingers; I put out the eyes of many soldiers. I built up a pyramid of the living and a pyramid of heads. On high I hung up their heads on trees in the neighborhood of their city. Their young men and their maidens I burned with fire. The city I overthrew, dug it up, and burned it with fire; I annihilated it."

A STAGGERING CRUELTY

The imagination is staggered at the very thought of that pyramid of the living—human beings piled one upon another, suffocating, strangling, perishing slowly and miserably before that other pyramid of their more fortunate friends to whom death had come swiftly, and at the thought of the monster who not only did this, but gloried in it, and caused the

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RUINS OF THE GORGEOUS PALACE OF NEBUCHADNEZZAR: BABYLON, MESOPOTAMIA

The civilization of Italy is young compared to the duration of civilization in the Euphrates Valley, if we calculate that the culture of modern Rome is approximately 2,800 years old. Assuming that the civilization of the Euphrates perished with the destruction of Babylon in 535 B. C. (see page 101), we know that it was already 3,300 years old, for back in 3800 B. C. there were already in existence on the banks of the Euphrates cities with culture and society and literature almost as complex as that of today.

story of his brutality to be written indelibly upon the walls of his house.

But this is not the whole of the picture. Side by side with the ruthlessness of this monster you have to place the other aspect of his nature, where you see him, a great and lordly gentleman, with a notable taste for the fine arts, planning and executing some of the most magnificent of buildings.

His great palace of Kalah stood 350 feet square on a high platform facing the temple which he had built to the god Ninib. In its center was a court measuring 125 feet by 100. Round this court were grouped the innumerable rooms and galleries of the great palace, chief among them the throne room, which measured 154 feet by 33. The curious narrowness of the chambers is very noticeable, showing the continued prevalence of the old Babylonian tradition, which was due to lack of good building stone and scarcity of timber.

Round each room ran a range of sculptured alabaster slabs, showing the king at war, at the hunt, fording the river, or marching through the mountains; while all the cruel details of his merciless warfare were represented to the life. Inscriptions ran along the slabs, giving practically a history of the king's reign from year to year.

The narrow galleries were roofed with cedar beams, decorated with gold, silver, and bronze, and gay with color. At the doorways stood monstrous figures of winged man-headed bulls or lions, head and shoulders carefully wrought out as though the creatures were leaping out of the walls, the rest left only suggested in outline. These were the divine spirits which guarded the entrance to the king's house.

DESCRIBES HIS PALACE

Ashur-natsir-pal thus describes his own palace: "A palace for my royal dwelling-place, for the glorious seat of my royalty, I founded for ever, and splendidly planned it; I surrounded it with a cornice of copper. Sculptures of the creatures of land and sea carved in alabaster I made, and placed them at the doors. Lofty door-posts of cedar wood I made, and sheathed them with copper, and set them upon the gates. Thrones of costly woods, dishes of ivory containing silver, gold, lead, copper, and iron, the spoil of my hand, taken from conquered lands, I deposited therein."

Such was a great Assyrian monarch on the evidence of his own records, which there is no reason to doubt; surely the strangest combination of absolute brute savagery and luxurious and artistic taste that has ever walked this earth. Multiply Ashur-natsir-pal by the dozen, and you have some idea of the misery and the slaughter for which the great Assyrian Empire was responsible during a period of at least 500 years.

SENNACHERIB RAVAGES PALESTINE

Ashur-natsir-pal was succeeded by Shalmaneser II (860-825 B. C.), first of the Assyrian kings who make mention of Israel in their inscriptions. He reigned for thirty-five years, and during that time he commanded in thirty-two campaigns, which gives an idea of how much spare time for peaceful industry was left to the Assyrian State. As a matter of fact, Assyria lived upon spoil. She was simply the greatest of all robber communities, and her staple industry was plundering the unlucky peoples who were rich enough to excite her envy and too weak to resist her violence.

Sennacherib was perhaps the most widely famous of all Assyrian monarchs. For us, of course, Sennacherib is the Assyrian who "came down like a wolf on the fold," and we think of him chiefly as the assailant of Judah, whose pride was so mysteriously brought low by the great disaster recorded in II Kings xix: 35: "The angel of the Lord went out, and smote in the camp of the Assyrians an hundred four score and five thousand; and when they arose early in the morning, behold they were all dead corpses."

As a matter of fact, however, Sennacherib's dealings with Hezekiah of Judah were but a small portion of a vast campaign, and the disaster which happened to his army, perfectly accurately recorded in Scripture, took place not near Jerusalem, but down on the frontier of Egypt.

What actually happened seems, so far as can be judged, to have been somewhat as follows: With the accession of the new Assyrian king came, as always, rebellion among the subject States. Egypt was busy in the background with promises of help, never to be realized, and all the Syrian States, including Judah, revolted. Sennacherib marched into Palestine, ravaging and destroying, laid siege to Ekron, and when the Egyptian army advanced to its relief, utterly defeated it at the battle of Altaku.

HEZEKIAH MAKES READY FOR WAR

Meanwhile Hezekiah had been making feverish preparations for defense against the storm which was about to burst upon him. He repaired the walls of Jerusalem, and in order to make certain that the waters of the spring Gihon should be secured for the city and not left for the besiegers, he dug the tunnel on the side of the southeast hill of Jerusalem, referred to in the Siloam inscription.

Sennacherib, fresh from his victory over the Egyptians, sat down before Lachish, and besieged and took it. While he was thus engaged, Hezekiah's heart failed him, and he sent his submission to the Assyrian king, as recorded in II Kings xviii: 13-16, paying a heavy tribute as the price of safety. Sennacherib, however, evidently doubted Hezekiah's faithfulness, and sent a division of his army under a political officer, the Rab-Shakeh, with a demand for surrender.

But on this occasion Hezekiah, encouraged by Isaiah, refused to yield any farther than he had already done, and Isaiah bade the king return a scornful and defiant answer, giving Hezekiah the assurance that the Assyrian should never even succeed in investing the city.

AN OUTBREAK OF BUBONIC PLAGUE?

So it came to pass. The conqueror had more important things to think of than the immediate destruction of a small and obscure city like Jerusalem. Jerusalem's turn would come in due time; meanwhile it could wait. So he marched with the main army straight on Egypt, leaving a division to mask Jerusalem. He encamped at Pelusium, on the Egyptian frontier, and everything was ready for a great battle which would have decided the fate of the ancient world.

And then some terrible obscure disaster—the legend that links it with mice suggests that it may have been an outbreak of the bubonic plague—overtook the Assyrian army. Sennacherib had to retreat with the broken remnants of his force, to call in his column from before Jerusalem, and to return discomfited to Nineveh. So Jerusalem was saved, as Isaiah had foreseen.

Sennacherib's own account of the campaign against Judah is as follows: "But Hezekiah of Jerusalem, who had not submitted to me, 46 of his walled towns, numberless forts and small places in their neighborhood I invested and took by means of battering-rams and the assault of scaling-ladders, the attack of foot-soldiers, mines, and breaches. Two hundred thousand, one hundred and fifty, great and small, men and women, horses, mules, asses, camels, oxen, and sheep without number I carried off from them and counted as spoil.

"Hezekiah himself I shut up like a bird in a cage in Jerusalem, his royal city. I raised forts about him, and the exits of the chief gate of this city I barred. . . . Himself the fear of my august Lordship overpowered. The Arabians and his faithful ones, whom he had brought in for the defense of Jerusalem, his royal city, fell away.

"Along with 30 talents of gold and 800 of silver, precious stones, carbuncles, *kassú* stones, great pieces of lapis lazuli, ivory thrones, elephant hides and tusks, *ushu* wood, boxwood, all sorts of things, a huge treasure, and his own daughters, the womenfolk of his palace, men and women singers he brought after me to Nineveh, the city of my Lordship; and for the payment of the tribute and to do homage he dispatched his envoy" (Taylor cylinder inscriptions).

HEZEKIAH'S TRIBUTE

This inscription bears out perfectly the account given in II Kings xviii: 13-16: "Now in the fourteenth year of King Hezekiah did Sennacherib, King of Assyria, come up against all the fenced cities of Judah, and took them. And Hezekiah King of Judah sent to the King

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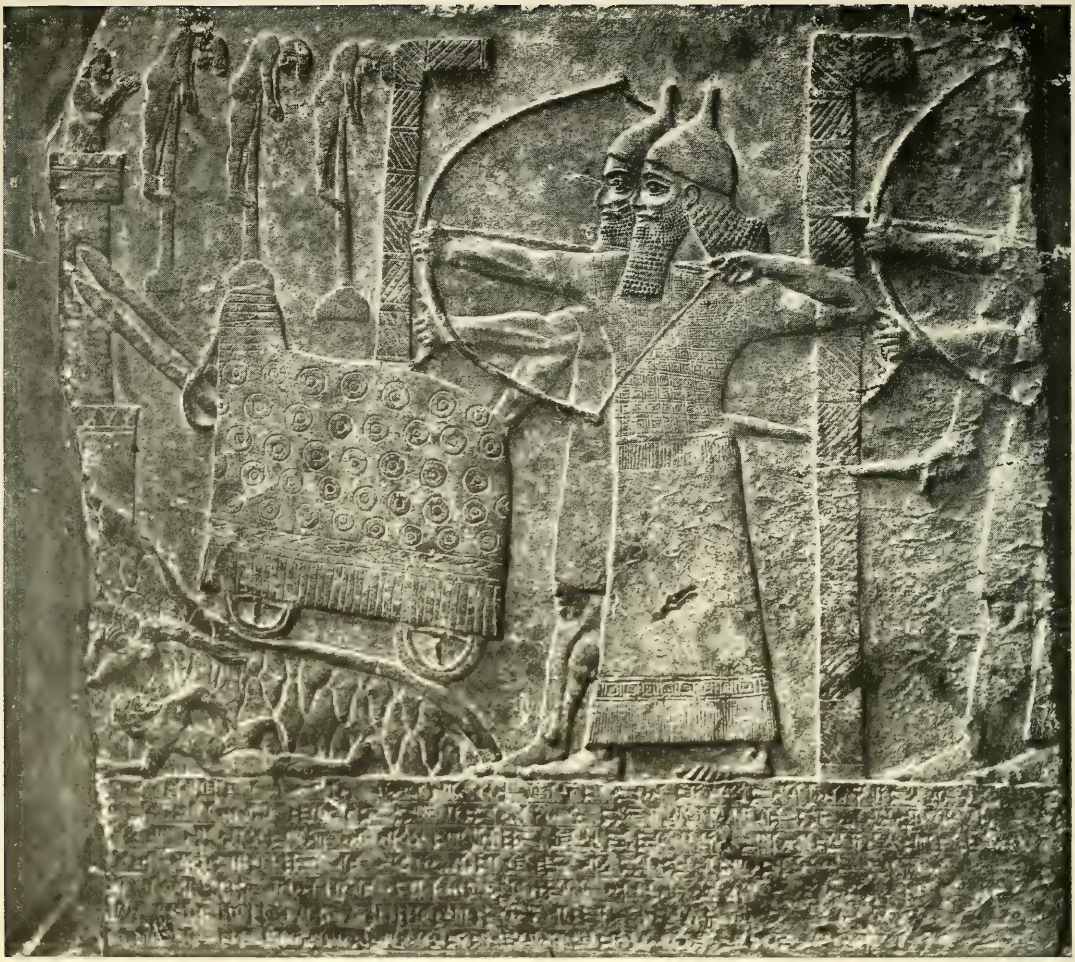
THE BRICK FLOOR OF NEBUCHADNEZZAR'S THRONE HALL, LOOKING TOWARD THE EUPHRATES: BABYLON

The outer wall of the palace was made of bricks stamped with the name of Nebuchadnezzar and was some 23½ feet thick, the inner wall, also made of brick, being over 44 feet thick, while the space between the two walls, nearly 70 feet, was filled in with sand and other material, the total thickness thus being nearly 136½ feet. The burnt bricks of which the retaining walls were composed were laid in asphalt and are so compactly joined that it is impossible to separate them into their layers.



HOW BABYLONIA AND ASSYRIA WAGED WAR

One might reconstruct the entire system of military tactics of Babylonian and Assyrian kings from the records in bas relief left by them on slabs of stone. In this picture we see the method of attacking a city with battering rams and archers. The impaled prisoners in the background show that Sherman's epigrammatic description of war fitted as well in 725 B. C. as it does in 1916 A. D.

of Assyria to Lachish, saying, I have offended: return from me; that which thou puttest upon me I will bear. And the King of Assyria appointed unto Hezekiah King of Judah three hundred talents of silver and thirty talents of gold. And Hezekiah gave him all the silver that was found in the house of the Lord, and in the treasures of the king's house. At that time did Hezekiah cut off the gold from the doors of the temple of the Lord, and from the pillars which Hezekiah King of Judah had overlaid, and gave it to the King of Assyria."

But while both records are at one as to the straits to which Hezekiah was reduced, the Assyrian inscription makes no claim with regard to the capture of Jerusalem; and its silence is quite as eloquent as a direct statement that Jerusalem was not captured would have been.

The Book of Kings records the death of the great enemy of Judah in these terms (II Kings xix: 36-37): "So Sennacherib King of Assyria departed, and went and returned, and dwelt at Nineveh. And it came to pass as he was worshipping in the house of Nisroch, his

FUGITIVES SWIMMING TO A FORTRESS ON INFLATED SKINS

god, that Adrammelech and Sharezer his sons smote him with the sword; and they escaped into the land of Armenia. And Esar-haddon, his son, reigned in his stead." Placed as it is immediately after the story of his disaster, this would lead us to suppose that the assassination took place immediately after his return from Palestine.

"BY THE RIVERS OF BABYLON"

As a matter of fact, however, something like twenty years elapsed between the one event and the other; and in the interval Sennacherib had fought many battles and made many conquests. Once more, like Sargon, he had conquered Babylon, and had utterly destroyed that ancient city, turning the waters of a canal across its site; while it was he who really made Nineveh the focus of Assyrian power, and so identified it with the fortunes of the nation that to name Assyria is to bring up the thought of Nineveh.

He left Nineveh, indeed, "that great city." The circuit of its massive walls was about seven miles, while outside the walls of the fortress-town itself the city suburbs stretched far into the country. The walls themselves were 100 feet high and averaged 50 feet in thickness, while at the gates this was doubled. Eighteen mountain streams poured their waters into the town, insuring a constant supply.

Even today the palace of Nineveh has only been partially explored; but the 71 rooms which have been excavated show that Sennacherib's splendid home was the greatest of all Assyrian palaces, while the artistic excellence of the wall sculptures is remarkable. All this greatness came, however, to a disastrous end in 681 B. C., when, like so many Assyrian monarchs, Sennacherib fell before the sword of the assassin.

King Ashurbanipal twenty years later made an end of Egypt's pretensions to rivalry with Assyria. Even Thebes, the great sacred city of the land, never before violated by the tread of foreign foes, fell before the irresistible Assyrian army, and Ashurbanipal and his troops returned in triumph "with full hands," as he says, to Nineveh.

THE FALL OF THEBES

The fall of Thebes made a profound impression upon the ancient world. Egypt's ancient fame had cast a glamour upon men's minds, which still obsessed them long after her real power had passed away. Nobody believed that she could ever be actually conquered, and when the impossible happened, and Thebes fell before the Assyrians, the whole world was amazed.

You catch the reflection of the general astonishment in the words of the prophet Nahum (iii: 8). Prophesying the fall of Nineveh, he compares her with Thebes, which had so lately fallen. "Art thou better," he says, "than No-Amon (Thebes), that was situate among the rivers, that had the waters round about it, whose rampart was the sea, and her wall was from the sea? Ethiopia and Egypt were

ASHURBANIPAL ON HORSEBACK SPEARING A LION WHILE ANOTHER LION ATTACKS THE HORSE WHICH THE KING LEADS

ASHURBANIPAL AND HIS QUEEN ENJOYING A CUP OF WINE

Ashurbanipal was a sort of a Napoleon of the ancient world—a warrior who took pride in his service to literature and art (see page 155)

TRIBUTE AND CAPTIVES

her strength and it was infinite. Put and Lubim were thy helpers. Yet was she carried away, she went into captivity; her young children also were dashed in pieces at the top of all the streets; and they cast lots for her honorable men, and all her great men were bound in chains."

Such was the miserable fate of the greatest of ancient capitals in those cruel days. Such before long was to be the fate of Nineveh herself.

FROM WAR TO WAR

From slaughter in Egypt Ashurbanipal turned cheerfully to slaughter in Babylonia. A great war arose with the old enemy Elam, and, in a fierce battle at Tulliz, the Elamite King Teumman was beaten and slain.

The famous reliefs representing the principal events of the battle give us the clearest possible pictures of Assyrian warfare, with all its ghastly cruelty. We see the stress of the conflict—the Elamite King making his final despairing stand and shooting his last arrow against his triumphant foes.

Then follows all the brutal savagery of victory. The King's head is hacked off with a dagger and borne in triumph before his conquerors. And then we have a picture of Ashurbanipal feasting with his wife and attendants in the garden of his palace, while from a tree before him hangs the ghastly head of the dead Elamite King, blackening in the sun. Such was an Assyrian conqueror and such were his pleasures.

Yet withal Ashurbanipal was one of the most enlightened of Assyrian monarchs. He had a great taste for literature, and in this respect we owe him an infinite debt. His scribes were commanded by him to make copies of the annals of Babylonia and Assyria from the libraries of all the most important cities in the land, and it is from these copies, made on clay tablets and preserved in the library of the king's palace, that the bulk of what is known of Assyrian and Babylonian history and religion has been learned. By the year 640 B. C. his campaigns were over. Henceforth he devoted himself to a life of literature, hunting, and luxury.

A MANY-SIDED MONARCH

Of all Assyrian monarchs he was by far the most splendid. His triumphs in the chase are recorded in magnificent reliefs, which remain for all time among the artistic treasures of the human race (see pages 154 and 202); his library was the greatest of ancient days, and its very wrecks are beyond comparison precious to us (see page 167).

It was his luxury, however, that chiefly impressed the world of his time. The fame of it crystallized at last into the well-known Greek tradition of how Sardanapalus, last of the kings of Assyria, lived a life of incredible luxury and self-indulgence, and how, at last, when besieged in his palace and hopeless of relief, he closed his career by erecting a vast and priceless funeral pyre, on which he

Photograph from Prof. Albert T. Clay

PAY-ROLL OF WOMEN WHO WERE CONNECTED WITH THE TEMPLE SERVICE FOR TWO MONTHS

The first two columns record the monthly payments, in grain; the third contains the total, and the fourth the name. The holes in the second and third columns are check marks. Only what is checked off was paid, as the sum total shows (see Professor Clay's article, pages 162-216). These tablets are in the University of Pennsylvania Collection.

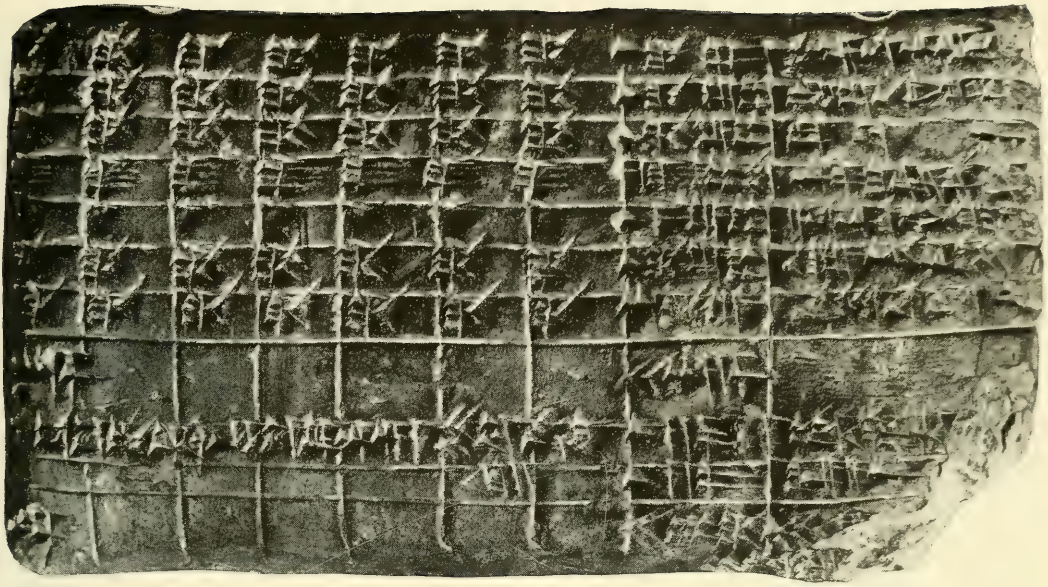
burned himself to death with all his harem and his personal attendants.

Sardanapalus is certainly meant for Ashurbanipal, seen through Greek spectacles; but he met with no such end. So far as we know, he did what few Assyrian kings managed to do—he died peacefully in his own palace. The Greek tradition has merely confused his fate with that of his second son, Sin-shar-ishkun, the last king of Assyria, who did burn himself in his palace after defeat.

All the same the reign of Ashurbanipal closes the glories of Nineveh. The great bully who had bestridden the ancient world for five centuries, slaughtering, torturing, robbing, and boasting, was now to fall, and to fall irremediably. For generations the Assyrian had boasted himself master of the world.

ISAIAH'S INDICTMENT

Isaiah has summed up his bluster and braggart spirit in a couple of verses (Isaiah x: 13, 14): "For he saith: By the strength of my hand I have done it; and by my wisdom; for I am prudent; and I have removed the bounds of the people, and have robbed their treasures, and I have put down the inhabitants like a valiant man; and my hand hath found as a nest the riches of the people; and as one gathereth eggs that are forsaken, have I gathered all the earth; and there was none that moved the wing or opened the mouth, or chirped." "Shall the axe," cries the prophet, "boast itself against him that heweth therewith?" The time had come for the axe to be broken and cast aside.



Photograph from Prof. Albert T. Clay

A WOMAN TAKING A MAN'S PLACE 3,200 YEARS AGO RECEIVED A MAN'S SALARY

This tablet gives the temple pay-roll for seven months, belonging to the fourteenth century B. C. Another, almost identical, was found written two years later. Three changes had taken place—one man's salary was raised, that of another was reduced, and a woman had taken a man's position, receiving the same salary that he had enjoyed.

Babylon, once the greatest city of the East, now for long trodden under the heel of Assyria, was stirring for her brief renaissance under a new dynasty. Her king, Nabopolassar, allied himself with Cyaxares, king of the Median highlanders, who were now descending from their mountains eager for conquest. Sin-shar-ishkun and his Assyrians were hopelessly defeated in the field, and after a desperate defense of Nineveh, lasting two years, the last Assyrian king shut himself up in his palace, with his wives and children, and perished in its blazing ruins.

The whole world held its breath for awhile. The news seemed too good to be true; and then everywhere one universal pæan of joy went up from the nations.

BABYLON'S TRIUMPH OVER EGYPT

Then Nabopolassar sent against the Egyptians his son Nebuchadrezzar, better known to us as *Nebuchadnezzar, the last outstanding specimen of the great race of fierce and ruthless soldiers* that this land produced.

Jeremiah has left a most vivid picture of the beaten Egyptian army streaming down in rout through Palestine. "Go up," he cries (xlvi: 11, 12), "into Gilead and take balm, O virgin daughter of Egypt; in vain shalt thou use many medicines; for thou shalt not be cured. The nations have heard of thy shame, and thy cry hath filled the land; for the mighty man hath stumbled against the mighty, and they are fallen both together."

JERUSALEM'S SURRENDER

Shortly after his great victory Nebuchadnezzar succeeded his father as king in Babylon. Jehoiakim of Judah became his vassal, but rebelled after three years. He died before the punishment of his folly had come upon the land, and when Nebuchadnezzar appeared before Jerusalem, his successor Jehoiachin surrendered himself to save his people.

Nebuchadnezzar deported him and 10,000 of the chief people of the land Finally, the last king of Judah, Zedekiah, after almost nine years of his reign had passed, tempted, as of old, by the vain promises of the Egyptian Pharaoh Haa-ab-ra (Hophra); did the most insane act he could, by breaking faith with the great King of Babylon.

Of course it was sheer madness, and

could have but one end. The Babylonian army surrounded Jerusalem, and after a desperate defense of 18 months the Holy City was taken (586 B. C.) (II Kings xxv, II Chronicles xxxvi, Jeremiah xxxix). Nebuchadnezzar was not quite so cruel as an Assyrian conqueror would have been, but he was cruel enough. He slew Zedekiah's sons before their father's eyes, and then blinded the vanquished king, that so his last earthly sight might be one of horror; then he swept him and the majority of the important people still remaining in the land into captivity. Thus miserably ended the rule of the House of David, having endured for about 414 years (1000-586 B. C.).

Nebuchadnezzar is always associated in our minds with the splendor of his great city, Babylon. "Is not this great Babylon which I have built?" And indeed he deserves such an association; and if ever a man had cause for pride as he surveyed the work of his hands, Nebuchadnezzar was that man as he looked abroad on Babylon. Great she had always been, reverenced as the mother city, and the source of learning and law even by her Assyrian conquerors in the day of her humiliation. But Nebuchadnezzar and his father had found her as the Assyrians had left her—powerless, humiliated, and sunk.

He raised her, within a generation, to far more than her ancient splendor—to a magnificence indeed which beggared description; so that even Rome, wonderful as its spell has been, has never been able to oust Babylon from the mind and imagination of the human race as the typical world-city, the emblem of all that is magnificent and luxurious and central. Ancient historians can find no words to describe the grandeur of the palaces, the temples, the hanging gardens of the great city by the Euphrates.

NEBUCHADNEZZAR A MAN OF PEACE

Great soldier as Nebuchadnezzar was, he was really by nature and instinct a man of peace, not of the merciless and unprofitable Assyrian type at all. "He was, in truth, a son of Babylonia, not of Assyria; a man of peace, not of war; a devotee of religion and culture, not of organization and administration," so says Goodspeed ("History of the Babylonians and Assyrians").

The same high authority remarks that "the picture of him in the Book of Daniel is, in not a few respects, strikingly accurate. His inscriptions reveal a loftiness of religious sentiment unequaled in the royal literature of the Oriental world." There can be no question of the dignity and reverence of some of the prayers used, or sanctioned for use, by the great king.

O eternal prince! Lord of all being!
As for the king whom thou lovest, and
Whose name thou has proclaimed
As was pleasing to thee,
Do thou lead aright his life,
Guide him in a straight path.
I am the prince obedient to thee,
The creature of thy hand;
Thou hast created me, and
With dominion over all people
Thou hast intrusted me.
According to thy grace, O Lord,
Which thou dost bestow on all people,
Cause me to love thy supreme dominion,
And create in my heart
The worship of thy godhead,
And grant whatever is pleasing to thee
Because thou hast fashioned my life.

Such a prayer is worthy to have come from the lips of him whom the Book of Daniel represents as saying: "Now I Nebuchadnezzar praise and extol and honour the King of Heaven; for all His works are truth, and His ways righteousness; and those that walk in pride He is able to abase" (iv: 37).

A SHORT-LIVED RENAISSANCE

Wonderful as was this renaissance of ancient Babylon under Nebuchadnezzar, it was destined to be a short-lived splendor. The great king was succeeded by weaklings, and a great new power, that of the Persians under Cyrus, was rising in the north. Nabuna'id, the last King of Babylon, was the most pious of monarchs, serving his gods with unexampled devotion.

In this respect we owe him no small debt; for it is his inscriptions on his restorations of ancient temples that have enabled modern scholars to arrive at approximate dates for the earlier Babylonian kings. What was wanted for Babylon them, however, was not a pious dilet-

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A PART OF THE CITY OF BABYLON WHICH HAS BEEN EXCAVATED CONTRASTED WITH A PART OF THE CITY THAT IS STILL COVERED WITH A GREAT ACCUMULATION OF DEBRIS

The deep, steep sides of the excavation show the immense amount of earth that was removed before these old dwellings were uncovered. (Contrast with the picture on page 195.)

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EXCAVATED HOMES OF NEBUCHADNEZZAR AND NEBOPALASSER IN BABYLON

The sphynx and the palm trees tell something of the story of the beauties of Babylon in ancient days—the one of magnificent sculpture and architecture and the other of landscape gardening at its best (see page 158).

tante, but a great soldier, and such a man she could not show.

When Cyrus with his Persians and Medes invaded Babylonia, Nabuna'id sent against them his son Belshar-utsur—the Belshazzar of the Book of Daniel. There is still extant a cylinder of Nabuna'id inscribed with a prayer to the gods on behalf of the young prince.

The prayer was not heard. Belshazzar was totally defeated. Nabuna'id shut himself up in Babylon, whose mighty walls and storehouses should have withstood siege for years, probably until the strength of the army of Cyrus was broken; but there was treachery within the gates. We are all familiar with the old story of how Cyrus diverted the Euphrates, marched his troops up the dry river-bed into the town and took it by surprise on a night of feasting. That is all pure romance.

CYRUS "A MAN WITH A MISSION"

We have the actual account of Cyrus's triumph, written by the hands of the men who in all probability were responsible for it—the treacherous priests of Marduk, the great god of Babylon. The relative part of the Cylinder of Cyrus runs thus: "Cyrus, King of Anshan, he (Marduk), called by name; to sovereignty over the whole world he appointed him. . . . Marduk, the great lord, guardian of his people, looked with joy on his pious works and his upright heart; he commanded him to go to his city Babylon, and he caused him to take the road to Babylon, going by his side as a friend and companion. . . . Without skirmish or battle he permitted him to enter Babylon."

In other words, the priests of Marduk intrigued with Cyrus, inviting him to advance against Babylon at first, and on his arrival delivering the city into his hands.

Gubaru (Gobryas), general of Cyrus, marched in unopposed. Nabuna'id was taken prisoner and kindly treated. But Belshazzar was of different metal. He, with the remainder of his forces, made a last desperate stand, and was slain in the hopeless defense of a city already conquered.

It is to this last despairing effort of the Babylonian crown prince that we must probably refer the scene of Belshazzar's feast (Daniel v). Such an ending—the last wild revel before the slaughter—would be perfectly in accordance with Mesopotamian and Babylonian traditions for the fall of royalty.

"BABYLON IS FALLEN"

So ended the Neo-Babylonian empire after a brief but splendid existence. The whole period of its endurance from the fall of Nineveh to that of Babylon was only 90 years (626-536 B. C.); but if we want to realize something of how the great city of the Euphrates and its monarchs had impressed the imagination of the subject peoples, we have only to turn to the fourteenth chapter of Isaiah, where, in one of the most wonderful pieces of taunting poetry in the literature of any land, Isaiah, himself in all probability a spectator of the fall of Babylon, records his thoughts and emotions at the ruin of the queen of cities and her king:

"Hell from beneath is moved for thee, to meet thee at thy coming; it stirreth up the dead for thee, even all the chief ones of the earth; it hath raised up from their thrones all the kings of the nations. All they shall speak and say unto thee: 'Art thou also become weak as we? Art thou become like unto us?'

"Thy pomp is brought down to the grave, and the noise of thy viols; the worm is spread under thee, and the worms cover thee. How art thou fallen from heaven, O Lucifer, son of the morning! How art thou cut down to the ground which didst weaken the nations. For thou hast said in thine heart: 'I will ascend into heaven; I will exalt my throne above the stars of God; I will also sit upon the mount of the congregation in the sides of the north; I will ascend above the heights of the clouds; I will be like the Most High.' Yet thou shall be brought down to hell, to the sides of the pit."

Photograph from Frederick Simpich

A THRONG OF PILGRIMS ON THE DESERT OUTSIDE OF BAGDAD PREPARING TO JOIN THE CARAVAN OF PILGRIMS FOR KERBELA AND NEDJEF

Before man came the land was waste. When he had learned to bridle its rivers and to develop its capabilities, it became "as the garden of the Lord." Now that he has lost the grip of his first inheritance, it has gone back to waste again. Yet there can be no doubt that here is a country of almost infinite possibilities, and that in the future, possibly not a very distant future, the first home of the race will again be one of the most fertile and perhaps one of the busiest spots in the world.

PUSHING BACK HISTORY'S HORIZON

How the Pick and Shovel Are Revealing Civilizations That Were Ancient When Israel Was Young

By Albert T. Clay

Professor of Assyriology and Babylonian Literature, Yale University

ONE of the romances of the last 75 years has been the unearthing of the remains of forgotten empires and the decipherment of their ancient records. A little over a half a century ago what was known concerning the ancient peoples of the nearer East, besides that which is contained in the Old Testament, could be written in a very brief form.

Israel was then regarded as one of the great nations of antiquity. Abraham belonged to the dawn of civilization. The references to other peoples in the Old Testament had little meaning, for few appreciated the fact that the history of many pre-Israelitish nations had practically faded from the knowledge of man.

The pick and spade of the explorer, however, and the patient toil of the de-

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THE PONTOON BRIDGE ACROSS THE TIGRIS RIVER AT BAGDAD

The circular boats, tied to the bridge, are like those which, 2,000 years ago, Herodotus described as being used on the river. "The boats which come down the river to Babylon are circular and made of skins. The frames, which are of willow, are cut in the country of the Armenians above Assyria, and on these, which serve for hulls, a covering of skins is stretched outside, and thus the boats are made, without either stem or stern, quite round, like a shield. They are then entirely filled with straw, and their cargo is put on board, after which they are suffered to float down the stream. Their chief freight is wine, stored in casks made of the wood of the palm tree. They are managed by two men, who stand upright in them, each plying an oar, one pulling and the other pushing. The boats are of various sizes, some larger, some smaller; the biggest reach as high as 5,000 talents' burthen. Each vessel has a live ass on board; those of larger size have more than one."

Photograph from Frederick Simpich

A GONDOLA POLED THROUGH THE SHALLOW CANALS THAT WATER THE GREAT DATE GARDENS: BAGDAD

cipherer have thrown a flood of light upon the situation; ruin-hills of the past have been opened up to the light of day, out of which emerge marvelous revelations in the form of written records and other remains.

ASTOUNDING REVELATIONS

These, although written in languages and scripts the very existence of which was unknown to man for two thousand years and more, are now forced to reveal their story of the religion, politics, science, and life of not a few of the ancient and forgotten peoples.

These researches have resulted in astounding revelations. Israel, instead of being one of the foremost nations of antiquity, is now found to have been a small power which had thrived in the late pre-Christian centuries, and had occupied a comparatively insignificant position among the great nations of its age. Instead of the patriarch Abraham belonging to the beginning of time, it is now found that he occupies a middle chapter in the history of mankind.

But, above all else, one of the greatest surprises is that the earliest peoples, instead of being barbarous or uncultured, were civilized and possessed a culture of a high order. In fact, the greatest creations of the Babylonians in literature and art belong to the third and fourth, and perhaps earlier, millenniums before Christ.

Political and religious institutions were already ancient in the days of the patriarchs. What may be regarded as primitive is found, but it points to a still greater antiquity than the earliest periods now known.

IMPERISHABLE RECORDS

Not only did the builders use brick instead of stone at Babel, but they also used clay for their writing material. Annual inundations deposited sand and clay of a fine quality in the valley, which was used for this purpose. The well-kneaded, but unbaked, inscription, lying perchance beneath the disintegrated abodes of the ruined building, though yearly and for millenniums saturated thoroughly by the winter rains or inundations, when carefully extracted from its resting place of

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JEWISH FAMILIES OF THE WELL-TO-DO AT THE WHARF: BAGDAD

This city, which was the scene of the Arabian Nights, is only 100 miles from ancient Babylon. There has been a considerable town here for 4,000 years; compared to it London is as of yesterday.

from two to six thousand years and allowed to dry, often appears as if it had been written yesterday. The original plasticity or adhesiveness of the sun-dried tablet returns, and if properly preserved will last indefinitely. The baked tablets, as would be naturally expected, on the whole are better preserved.

The well-kneaded clay, which had been washed to free it from grit and sand, while in a plastic condition was shaped into the form and size desired. As the style of paper used at the present time is frequently an indication of the character of the writing, the same is true, in a general way, of an ancient Babylonian clay tablet or cylinder. In most instances the trained Assyriologist at a glance can determine the character, in a general way, of an inscription by its shape or appearance.

The stylus, which was made of metal or wood, was a very simple affair. In the early periods it was triangular and in the later quadrangular. By holding it beneath the hand between the thumb and second finger, with the index finger on top, and pressing the corner of it into the soft clay, the impression made will be that of a wedge; hence the term cuneiform (from the Latin *cunues*) writing.

The cuneiform script, written upon clay, was employed by many different peoples of western Asia.

EARLIEST KNOWN RECORDS

The date of the earliest known inscription is still undetermined. The chronology prior to 2400 B. C. is still in a chaotic state, and yet the recent discovery of a tablet giving several new dynasties, besides many other facts which have been ascertained, offer sufficient indications of a much greater antiquity for the earliest known inscriptions than have been credited them.

The illustration of the Hoffman tablet (on page 167), in the General Theological Seminary, New York city, shows one of the few known archaic inscriptions. To assign it the date 5000 B. C. would be a modest reckoning. And yet the characters are so far removed from the original pictures that in most instances it is only by the help of the values they possess that the original pictures can be surmised. This tablet, tentatively translated by Professor Barton, of Bryn Mawr, reads as follows:

"3005 Bur of a field of clay in Ushu, of the land of the setting sun, belonging to the priest Sallaltur; 36050 cubits on its Akkadward side, the lower, from the beginning; 36050 cubits running along the breadth of the ziggurrat of Shamash, the brilliant lady; 36000 cubits to the temple of Shamash, the messenger of Ab, the brilliant; 36050 cubits on the side of the mountain, the abode of Shukura, the *pa-azag*. May he give strength; may he bless."

BRONZE AND STONE INSCRIPTIONS

While in all known periods clay was the writing material, important royal documents, votive and historical inscriptions, etc., are found on stone, and in some instances on bronze. In cutting such inscriptions the scribe imitated the characters made in clay with the stylus.

Not unlike other scripts, the cuneiform was originally pictorial; but, as in Egypt, the hieroglyphs became more and more simplified and conventionalized.

But, unlike the Egyptians, the Babylonian or Sumerian became conventionalized at a time prior to the known history of the land; and the hieroglyphs were not continued in use even for monumental purposes, but were practically lost sight of.

There are known over six hundred signs. Each of these has syllabic and ideographic values from one to more than a hundred. Combination of two and three signs have ideographic values, so that there are known at present twenty thousand values for the six hundred signs. Besides the characters are different in every age, due chiefly to the process of simplification that went on continually.

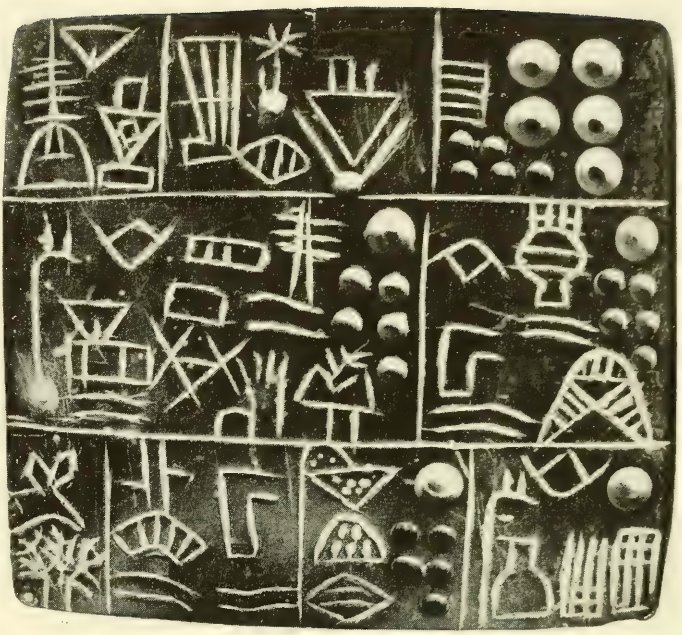
Practically every man of any standing in ancient Babylonia had a seal cylinder or seal, the impression of which upon the document or letter served the purpose of his signature. Thousands of these have been found, cut out of all kinds of hard stone, which had been imported from distant lands, for Babylonia is an alluvial plain.

As a substitute for a seal the individual could make his thumb-nail mark upon the soft clay, or impress upon it a portion of

his *ziziktu,* which was a cord attached to an undergarment. This, in all probability, is to be identified with the *zizith* mentioned in the Old Testament (Num. 15:38, 39), and even at the present time worn by orthodox Hebrews.

BABYLONIAN "STENOGRAPHERS"

In all periods scribes are very numerous. This is inferred from the fact that in some periods almost every document is found to have been written by a different scribe. In the Assyrian period women are known to have belonged to this profession. The scribes wrote the legal documents, as well as the private letters of individuals. They even placed the seal impression upon the legal document, in proximity to which they wrote the name of the person to whom it belonged, usually the obligor or the witness.



Photograph from Prof. Albert T. Clay

A WRITTEN RECORD AT LEAST 7,000 YEARS OLD

This is the Hoffman Tablet, in the General Theological Seminary, New York City. This is one of the most ancient of all human writings. To assign it the date of 5000 B. C. would be a modest reckoning (see text, page 166).

In the time of Hammurabi (about 2000 B. C.) there was at hand an officer called the Burgul, who was prepared to cut temporary seals upon a soft material for those who did not possess them. This is the custom in Oriental lands in the present day.

In Constantinople, for instance, the curbs of certain streets are lined with scribes prepared to write for the illiterate. An occasional man among them is provided with little blank stamps in soft brass, and with an engraving tool is prepared to cut the signature or initials of the man upon one of them while he waits. The impression of the stamp is affixed to his letter in place of his signature.

THE "CONGRESSIONAL LIBRARY" OF NINEVEH

The cuneiform inscriptions in clay, stone, and metal that now repose in museums and in private collections number hundreds of thousands.

Several ancient libraries and immense archives have been found. Years ago the literary library of Ashurbanipal (668-626 B. C.) was discovered at Nineveh. It appeared to the excavators that the library had been deposited in the upper chambers of the palace, and that when the building was destroyed they fell through to the lower floors, where they were found in masses.

The inscriptions showed that they had been arranged according to their subject in different positions in the library. Each series had a title, being composed generally of the first words of the first tablet. Usually at the end of each tablet its number in the series was given.

In the library were found epics, religious, astrological and magical texts, chronicles, paradigms, syllabaries, etc. This is the only library that has been found in Babylonia or Assyria which can be regarded as a literary library, where efforts had been made to assemble literary and other works produced at times not necessarily connected with the era to which the library belonged.

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THE EXCAVATED SITE OF ASSUR, A COLONY OF BABYLON

Parts of the city's walls, quays, streets, palaces, and temples have been laid bare

The scribes of Ashurbanipal searched the temples and schools of Babylonia and Assyria for these productions and rewrote them in what was then modern Assyrian (see page 155).

There are many indications of the transcription of older texts, or the handing down of them from one period to another. Not a few tablets in the Ashurbanipal library have subscriptions or colophons stating that they are copies written according to originals found in such and such a city.

Several instances of earlier versions have been found. For example, there is a version of the Gilgamesh represented in the Yale collection by a tablet, and in the Berlin Museum by a fragment which belong to a time fifteen hundred years earlier than the library of Ashurbanipal.

The same is true of the deluge story, which is represented by more ancient versions. Moreover, the one in the library of J. Pierpont Morgan, dated about 2000 B. C., clearly shows that it is a copy of a still older version. Not only is the

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ROUND-ROOFED TOMBS OF OLD ASSUR

Assur was the earliest capital of Assyria. It is therefore one of the most ancient of cities. It stood for more than 2,000 years, although long superseded as capital and trading center.

name of the scribe who made the copy given, but where the original was defective he wrote "broken."

In more recent years temple and school libraries have been found at Nippur, Sippar, Larsa, Babylon, and Erech. The libraries of the first three sites belong chiefly to the third millennium B. C.; those of the last two belong to later periods.

They are primarily temple school libraries, and contain also the tablets used by the different priests in the temple service, as hymns, prayers or liturgies, omen or divination texts; also syllabaries or dictionaries, grammatical exercises, mathematical texts, etc. At Nippur school library material belonging to the second millennium was also found.

Besides these libraries immense archives of temple administrative documents belonging to all periods have been found in practically all sites where excavations have been conducted by the Occidental or by the illicit diggings of the Oriental.

GOVERNMENT ACCOUNTS CAREFULLY KEPT

But especially large archives of these documents, numbering several hundred thousand and belonging to the third and fourth millenniums B. C., have been found at Tello, Nippur, Drehem, Jokha, and recently at Ur.

These tablets record the payment into the temple stores of tithes or offerings of drink, vegetables, or animals, of taxes, rents, loans, and also the disbursement of this property. The temple stood in relation to the people as the State does in modern times, and these are the records of administration.

Exhaustive accounts were kept of what was received and what was disbursed. Great storehouses held the income. There were immense cattle yards, in which the property of the temple in live stock was cared for, as, for example, the one at Drehem, close by the city of Nippur.

The cattle not disposed of were intrusted to herdsmen, with whom contracts were made, setting forth their responsibilities and regulating their profits; documents referring to granaries, freight boats, messengers; to payments of temple officials; in fact, records similar to the business transactions such as are ordinarily found in the administrative offices of our present-day institutions.

Next to the temple documents, in point of numbers, come the legal and business documents of the Assyrians and Babylonians. One hundred thousand tablets of this character would be a reasonable estimate of this class of literature in the different museums and private collections, belonging to all the periods. These documents are one of the most fruitful sources of light thrown upon the everyday life of the people, not to mention the valuable historical and chronological data gathered from them.

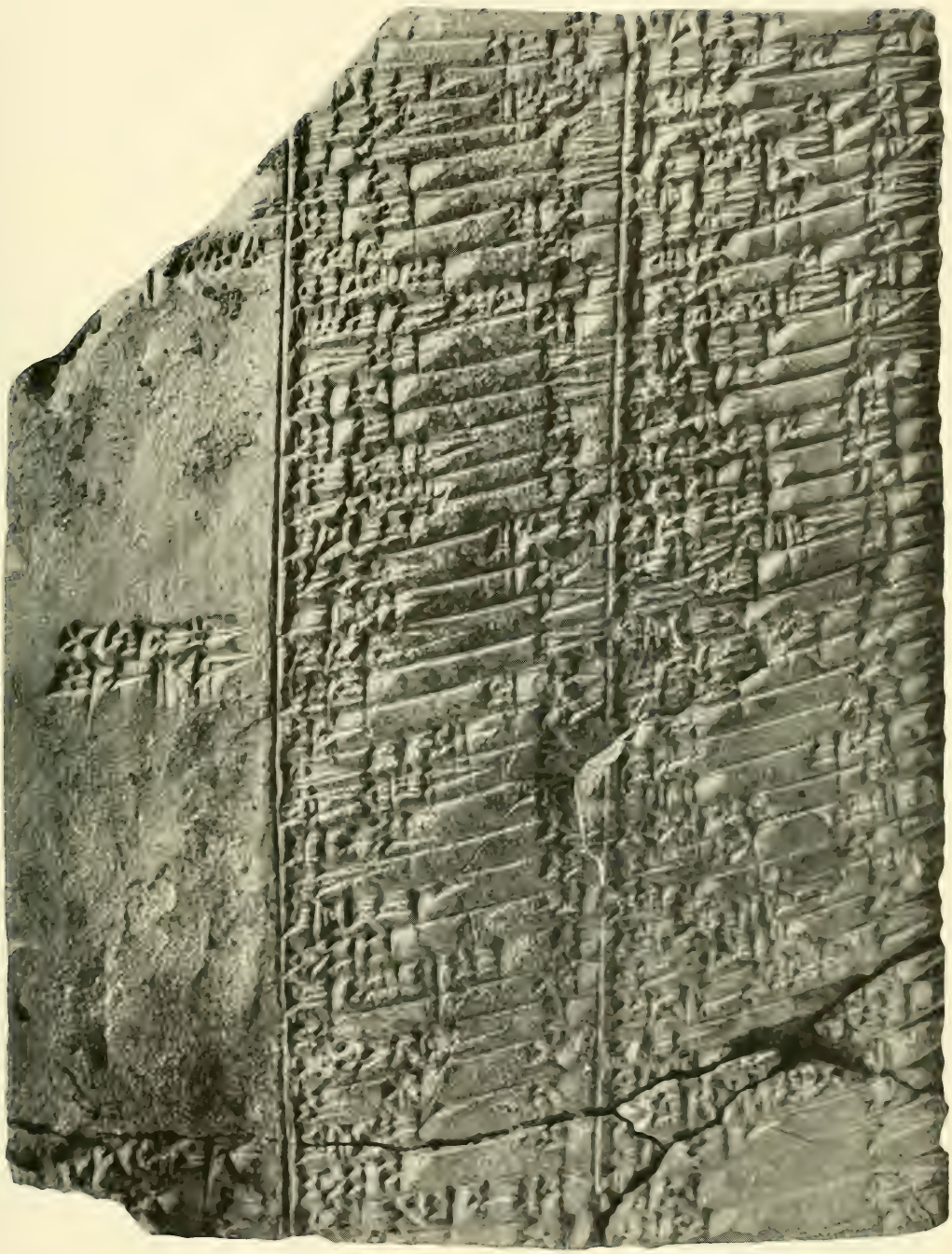
AN ANCIENT MARRIAGE CONTRACT

There are dowry and marriage contracts, partnership agreements, records of debts, promissory notes, leases of lands, houses, or slaves, deeds of transfer of all kinds of property, mortgages, documents granting the power of attorney, tablets dealing with the adoption of children, divorce, bankruptcy, inheritance; in fact, almost every imaginable kind of deed or contract is found among them. Following is an example of a marriage contract:

"Nabû-nâdin-akhi, son of Bêl-akbê-iddin, grandson of Ardi-Nergal, spoke thus to Shum-ukina, son of Mushallimu: 'Give me thy Ina-Esagila-banat, the virgin, to wife to Uballitsu-Gula, my son.' Shum-ukina hearkened unto him, and gave Ina-Esagila-banat, his virgin daughter, to Uballitsu-Gula, his son. One mina of silver, three female slaves, Latubashinnu, Ina-silli-esabat and Taslimu, besides house furniture, with Ina-Esagila-banat, his daughter, as a marriage-portion he gave to Nabû-nâdin-akhi. Nanâ-Gishirst, the slave of Shum-ukina, in lieu of two-thirds of a mina of silver, her full price Shum-ukina gave to Nabû-nâdin-akhi out of the one mina of silver for her marriage-portion. One-third of a mina, the balance of the one mina, Shum-ukina will give Nabû-nâdin-akhi, and her marriage-portion is paid. Each took a writing (or contract)."

This is followed by the names of six witnesses, that of the scribe, and the date.

It is from the contract literature that we become familiar with the life which pulsated in the streets and the homes of the ancients who lived in Babylonia and Assyria so long ago. Through it we learn to know the personalities of the



Photograph from Prof. Albert T. Clay

A TABLET CONTAINING THE EARLIEST-KNOWN LAWS: BABYLON (SEE PAGE 175)

These laws were written in Sumerian about 4,200 years ago. It is believed that they formed the basis of the Hammurabi Code, issued in 2000 B. C., just as British laws furnished the basis of our own in our early history. This tablet is in the Yale Collection.

people, their plans, their needs, and the things against which they guarded, which, it might be said, are the same as those familiar to us in the present day.

A TRIBUTE TO THE BABYLONIANS

Again and again are we forced to exclaim as we become acquainted with the doings of the ancients from these sources that our boasted civilization has developed very little in the essentials of life.

These documents are so numerous that we will know individuals of certain periods more intimately than we know of some of the centuries of our Christian era. When the tablets, for example, of the first dynasty of Babylon, about 2000 B. C., have been published, the history and geneaologies of many families covering several generations will be known. In the late period several old families of Babylon and Erech can be traced for centuries, notably the Egibi of Babylon and such families as Ekur-Zakur, Akhutu, etc., of Erech.

SAFEGUARDS AGAINST FORGERY

Not a few of the contracts, especially of the early period, were encased in a thin layer of clay, which served the purpose of an envelope. The contents of the document are usually duplicated on the case, which also contains the seal of the obligor. It was less difficult to alter amounts on a clay tablet than it is at present upon paper; when the document was encased and the envelope bore the seals of the obligor, and in many instances of the witnesses, the obligee, who held the document, could alter the envelope, but he could not change the tablet; for if he peeled off the case which contained the impressions of the obligor's seal he could not replace (see page 179).

The number of official and personal letters of most periods that have been found is also quite large. From the royal letters, such as those of Hammurabi to one of his governors, or those found in the library of Ashurbanipal, considerable information is gained dealing with the civil affairs in the land and with foreign affairs of other lands, especially Armenia and Elam.

The letters of Hammurabi that have been found were addressed to one of his governors, stationed at Larsa. They had been encased, and the envelope contained something like "To Sin-idinnam." On the receipt of the letter the case was peeled off. It began: "Unto Sin-idinnam, thus says Hammurabi."

His letters show that he gave personal oversight to the minor affairs of his kingdom. Special attention is devoted to the construction and dredging of canals. He superintended the collection of revenues and exercised control over the priesthood. He punished money lenders for extortion or for failing to cancel mortgages after they had been satisfied.

REGULATING THE CALENDAR

One of his letters shows how the calendar was regulated. As the Babylonians observed the lunar month, it became necessary to insert an intercalary month every third year. In a letter to Sin-idinnam, after calling attention to the fact that the year was deficient, he ordered that the month upon which they were entering should be called "Second Elul" instead of Tishri, the month that followed Elul.

But he added: "Instead of the tribute arriving in Babylon on the 25th day of Tishri, let it arrive in Babylon on the 25th day of Second Elul." That is, he pushed forward the calendar; but he was unwilling to wait a month for his revenues.

The letters of a private character throw light upon personal affairs. These deal with all the different phases of life. The father is reminded of a broken promise; his son writes him that "thou, my father, didst say that when I went to Dur-Ammi-Zaduga . . . 'I will send a sheep and five minas of silver, in a little while, to thee.'"

A tenant desires a good cow and a creditor compels his debtor to meet his obligations. A prisoner pleads with his master for deliverance, calling the jail a starvation house, and asserting that he is not a robber, but the victim of the Sutu, who fell upon him and took away the oil he was carrying across the river.

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"THE WATERS ASSUAGED": GREAT PLAINS LEFT AFTER FLOODS IN MESOPOTAMIA

Both the Babylonians and the Assyrians preserved accounts of a great deluge. The Assyrian hero of that world calamity was Gilgamesh, who corresponded to Noah in the Hebraic account of a great catastrophe which destroyed all mankind (see pages 168 and 212).

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THE BURIED CITY OF NINEVEH, WHERE THE "CONGRESSIONAL LIBRARY" OF ASHURBANIPAL WAS FOUND (SEE PAGE 167)

Conditions that favor quick rise of a civilization also hasten its decay. Nebuchadnezzar informs us that half a century served to reduce a temple to a state of decay if it were left uncared for. That explains why the weathering processes have left so many cities nothing more than big mounds of crumbled clay.

Photograph from Prof. Albert T. Clay

AN ASPHALT SPRING IN MESOPOTAMIA

It is probable that it was this bitumen to which Genesis refers where it says "they had brick for stone, and slime had they for mortar"

A LOVE LETTER OF LONG AGO

A young man sends his endearing inquiry concerning the health of his beloved, saying: "To Bibea, thus says Gimil Marduk: may the gods Shamash and Marduk permit thee to live forever for my sake. I write to inquire concerning thy health. Tell me how thou art. I went to Babylon, but did not see thee. I was greatly disappointed. Send the reason for thy leaving, that I may be happy. Do come in the month Marchesvan. Keep well always for my sake."

The letters, besides being extremely valuable for rewriting the political history and the life and customs of the people, offer most important philological and lexicographical material.

Many of these also were encased, but only the address, with the seals of the sender, appear on the outside. Not a few letters have been found encased in their original envelopes—*i. e.,* they are unopened. They can only be explained as being duplicate copies retained by the sender.

The Code of Hammurabi, written about 2000 B. C., upon a large and somewhat irregular stele, is perhaps the most important monument of antiquity that has been found for a century. It is the product of a civilization of a high order. In codifying his laws, Hammurabi arranged them in a definite and logical order, based upon accepted judicial decisions (p. 141).

It is now definitely ascertained, as had been inferred, that the code is based on other codes that preceded it. In the Yale Babylonian collection there is a tablet written in Sumerian, which seems to be a prototype of the code. Although it is not dated, the script indicates that it is older than the Hammurabi Code (p. 171).

ALL CONTINGENCIES COVERED

A number of its laws bear upon subjects covered in what are known as the Sumerian family laws, but which are, nevertheless, quite distinct. Others deal with the leasing of boats and animals, even making provision, as does the Hammurabi Code, when a lion kills a hired animal. But especially interesting is the fact that there are two laws dealing with the injury of pregnant women, which have been contracted into one law that is found in the code.

It is not impossible that the code was extensively influenced from sources distinctly Semitic; perhaps Aramæan. This

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AN ARAB HOME IN BABYLONIA

is suggested by such episodes as the story of Hagar in the Old Testament, which is not in accord with the Mosaic Code, which was doubtless extensively influenced by the Amorite culture, but is similar to the Babylonian.

Abraham may have become acquainted with Babylonian law while sojourning in southern Babylonia, if the theory that Ur of the Chaldees is to be located in that region; but it is more probable that he learned it in Aram, his ancestral home.

On some subjects but one law is given, while upon others as many as thirty. The following brief outline will afford an idea of the subject-matter treated: Witchcraft, witnesses, judges; concerning offenses involving the purity of justice, as tampering with witnesses, jury, or judge; crimes of various sorts, as theft, receiving stolen goods, kidnaping, fugitive slaves, burglary; duties of public officers in their administration; laws relating to landlords, tenants, creditors, debtors; canal and water rights, licenses, messengers, herdsmen, gardeners, slander, family relationship, marriage, divorce, desertion, breach of promise, adultery, unchastity, concubinage; rights of women, purchase-money of brides, inheritance, adoption, responsibility for all kinds of assaults; fees of surgeons; branding of slaves, fees and responsibilities of builders and boatmen; hiring of boats; agricultural life, the purchase and punishment of slaves who repudiate their master, etc.

GRADES OF SOCIETY

In no better way is it possible to become acquainted with the every-day life of the ancient Babylonian than by a careful study of the Hammurabi Code.

The code recognizes three grades of society—the aristocrat, or gentleman, the

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LOOKING FROM THE SITE OF SENNACHERIB'S PALACE ACROSS THE TIGRIS TO MOSUL

"Sennacherib was perhaps the most widely famous of all Assyrian monarchs. For us, of course, Sennacherib is the Assyrian who 'came down like a wolf on the fold,' and we think of him chiefly as the assailant of Judah, whose pride was so mysteriously brought low by the great disaster recorded in II Kings xix: 35: 'The angel of the Lord went out, and smote in the camp of the Assyrians an hundred four score and five thousand; and when they arose early in the morning, behold they were all dead corpses'" (see page 149).

Photograph from Prof. Albert T. Clay

PAY-ROLL OF TEMPLE OFFICIALS: UNIVERSITY OF PENNSYLVANIA COLLECTION

The payments for six months are followed by the total in the seventh column. The second half-year payments are also followed by the total and the sum total in the fifteenth column. This is followed by the names and the offices held. In the eighth line payments were made only for the first six months. Following the names is written "From Tishri road," meaning leave of absence. The last three names on the obverse have the word "dead" written before them. On the reverse a man's name is followed by a woman's, after which is written "his bride." As neither received payment, it is reasonable to suggest that they were on their honeymoon.

Photograph from Prof. Albert T. Clay

UNOPENED LETTERS WRITTEN IN THE DAYS OF ABRAHAM, ABOUT 2000 B. C.

The clay envelope contained the name of the individual addressed and the seal impression of the sender. The reason that the letters have not been opened is that they are copies of the original letters, used for filing purposes. Note that the envelope on the right has been broken at the top and the letter is exposed. These letters are now in the Yale Archæological Collection. Babylonia had a postal system, and it is known that there were regular dispatches between some of the principal cities. Among the large amount of material unearthed have been a great number of shipping tags made of clay. These have upon them the name and address of the party to whom the merchandise was dispatched. The tags were usually made of small lumps of burnt clay.

Photograph from Prof. Albert T. Clay

SAFEGUARDS AGAINST FORGERY IN USE 3,800 YEARS AGO IN BABYLONIA

A clay tablet, with its case, upon which was written the deed in duplicate form, and containing the seal impressions of the obligor and witness. If the obligee removed the envelope he could not replace it.

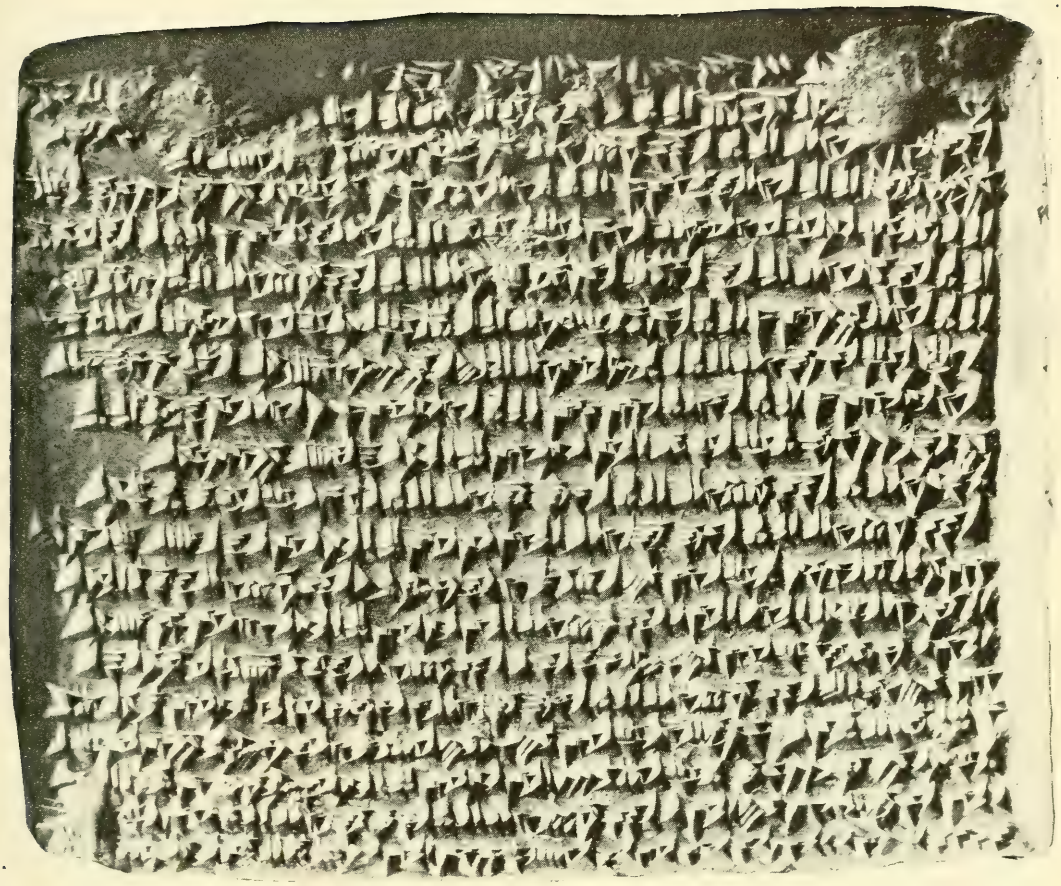
poor man, or pleb, and the slave. Among the ranks of the first mentioned were the professional men, the officers, and the tradesmen. The second class included the freedman who had been a slave.

There was a graded scale for these three classes as regards offerings that were imposed upon them. Besides these three grades in society, the code legislated also for certain classes of men and women, professions and trades.

It has been the custom with most peoples in a large part of the ancient, as well as the modern, Orient to base a betrothal upon an agreement of the man or his parents to pay a sum of money to the girl's father. In Babylonia this "bride money," together with the gift of the father and other gifts, formed the marriage portion which was given to the bride.

There were prudential reasons for this practice. It gave the woman protection against ill-treatment and infidelity on the part of the husband, as well as against divorce; for if she returned to her father's house she took with her the marriage portion unless she was the offending party. If she died childless, the portion was returned to her family. If she had children, the marriage portion was divided among them.

In case the girl's father rejected the suitor after the contract had been made, he was required to return double the amount of the bride price. The betroth-



Photograph from Prof. Albert T. Clay

A DEED OF TRANSFER OF A CULTIVATED ESTATE, WRITTEN 2,100 YEARS AGO

While no proof has come to us that Babylonia and Assyria had a Wall Street, there is much evidence in the contract literature that the men and women loved to speculate in those days just as much as they do in modern times. A great many tablets have been unearthed, which show that partnerships were formed for the purpose of buying wheat and other grains before they were harvested for future delivery. While there is nothing to indicate that these purchases were on "margins," yet the advanced stage of civilization shown by many of the laws might well lead to the belief that "margins" as well as "futures" were known in ancient Mesopotamia.

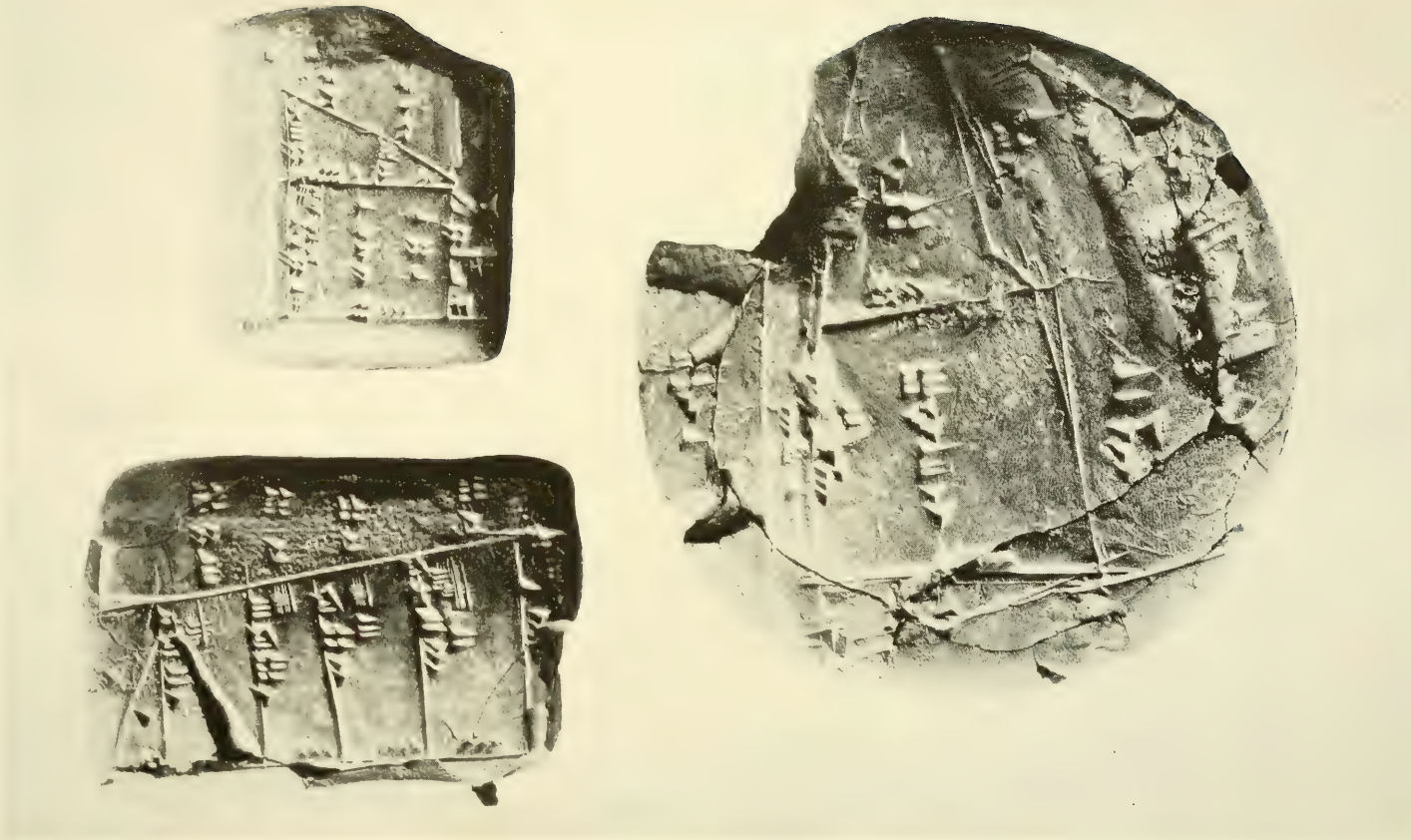
als took place usually when the parties were young, and as a rule the engagements were made by the parents. If the father died before all the sons were married, when the estate was divided the sums needed for those not having wives were deducted before the distribution was made.

MARRIAGE CONTRACTS REQUIRED

A marriage contract was necessary to make a marriage legal. In some of them peculiar conditions were made, such as the bride being required to wait upon the mother-in-law, or even upon another wife. If it was stipulated that the man should not take a second wife, the woman could secure a divorce in case her husband broke the agreement.

Concubinage, as in the case of Abraham, was indulged in, especially when the wife was childless and she had not given him a slave maid that he might have children. The law fully determined the status of the concubine and protected her rights.

At the husband's death the wife received her marriage portion and what was deeded to her during the husband's life. If he had not given her during his life a portion of the estate, she received



Photograph from Prof. Albert T. Clay

PLANS OF ESTATES, WITH MEASUREMENTS: YALE ASSYRIAN COLLECTION

The deeds of bargain and sale of property in Babylonia and Assyria were so careful to describe and plot the metes and bounds of the property transferred that surveyors say that they could, if they had all the deeds for Babylon or Nineveh, map the city and assign every lot to its proper owner

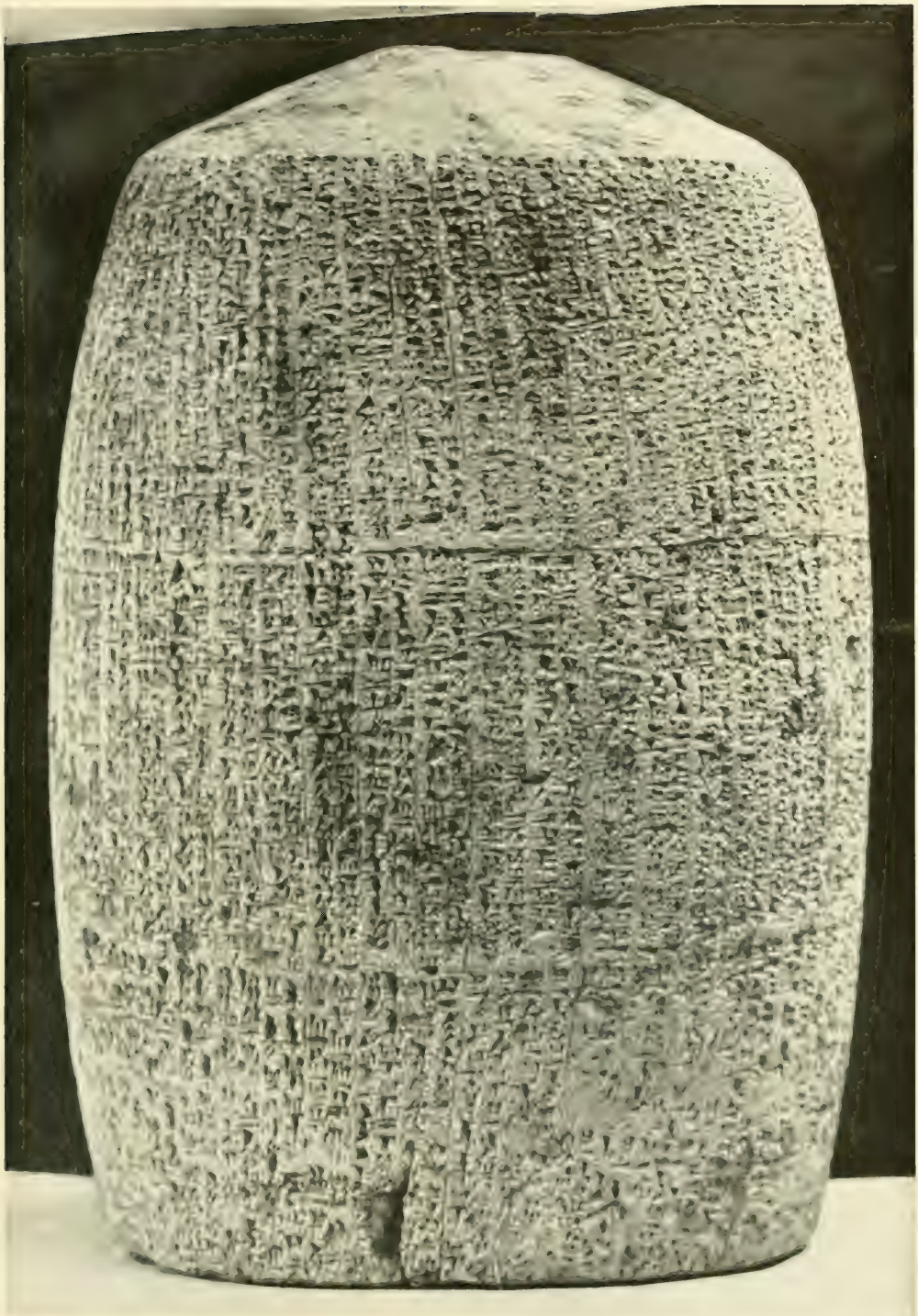


Photo from Prof. Albert T. Clay

CYLINDER OF NEBUCHADNEZZAR, RECORDING THE KING'S BUILDING OPERATIONS IN A NUMBER OF CITIES IN BABYLONIA

"On a cylinder found at Wana-Sedoum, King Nebuchadnezzar recounts his restorations of various temples, saying: 'From distant days its old foundation stone no previous king had seen. Its old foundation stone I sought for, I beheld, and upon a foundation stone of Naram-sin, my ancient ancestor, I laid its foundation. An inscription with my name I made and placed in the midst of it.'" The foundation stone that Nebuchadnezzar sought for and beheld has been found (see text, pages 209-210).

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THE BRIDGE OF BOATS ACROSS THE TIGRIS AT MOSUL

Photograph from Frederick Simpich

MOHAMMEDAN PILGRIMS ON A TIGRIS RIVER BOAT

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A CROWD IN THE BAZAAR OF MOSUL, A MOHAMMEDAN TOWN ON THE TIGRIS RIVER, OPPOSITE NINEVEH

The artisans of Babylonia were always ready to guarantee their workmanship. A tablet found in one site was a written guaranty that an emerald set in a gold ring would not fall out for twenty years, reading thus: "As concerning the gold ring set with an emerald, we guarantee that for twenty years the emerald will not fall out of the gold ring. If the emerald should fall out of the gold ring before the end of twenty years, Ellil-akh-iddin and Belshunu and Kahtin shall pay to Ellil-shun-iddin an indemnity of 10 mina of silver."

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THE MARKET-PLACE OF MOSUL, A FEW MILES FROM THE SITE OF ANCIENT NINEVEH

Photograph from Frederick Simpich

CARAVAN WITH WOOL FOR BAGDAD, MESOPOTAMIA

It was through this country that the railroad from Asia Minor to Bagdad was being built before the outbreak of the present war in Europe. The original concession, given in 1903, permitted the construction of the road by the Bagdad Railway Company from Constantinople to the Persian Gulf, and further permitted the levying of import dues for the payment of mileage subsidies granted by the Turkish government to the company. The right to build the road farther than Bagdad was revoked in 1911, as was also the right to a lien on import duties as security for building subsidies. The Bagdad Railway issue figured prominently in Near Eastern diplomacy for more than a decade before the clash of arms in Europe.

Photograph from Frederick Simpich

ARAB VEHICLES, USUALLY DRAWN BY FOUR MULES, USED FOR TRAVEL IN MESOPOTAMIA

Before the outbreak of the European war English capitalists were planning to spend a total of $130,000,000 on irrigation projects in Mesopotamia, under the leadership of Sir William Willcocks. It was estimated that this would irrigate 3,500,000 acres of land and would bring an income of 9 per cent on the investment. A total of 12,500,000 acres was found to be susceptible of modern irrigation.

a son's share and was permitted to retain her home, but she could marry again. A widow with young children could only marry with the consent of the judge. An inventory of the former husband's property was made and it was intrusted to the couple for the deceased's children.

The code provided that if a man divorced a woman she received her marriage portion. In case there was no dowry, she received one mina of silver if the man belonged to the gentry, but only one-third of a mina if he was a commoner.

For infidelity the woman could divorce her husband and take with her the marriage portion. In case of a woman's infidelity, the husband could degrade her as a slave; he could even have her drowned. In case of disease, the man could take a second wife, but was compelled to maintain his invalid wife in his home. If she preferred to return to her father's house, she could take with her the marriage portion.

MEN HAD TO SHOW GOOD CAUSE BEFORE THEY COULD DISINHERIT A CHILD

The father had no right over the life and death of his child, but he could treat it as a chattel. If he pledged a child for a debt, it became free in four years. For disobedience the father could cut off his hands. If a father desired to favor a son, he could only do so during life, and then by contract, for after his death the laws of inheritance fixed the child's share.

Charges of wrong-doing before a judge were required before a son could be cut off from sonship. It was only after a second offense and for a serious misdemeanor that a child could be so disinherited.

The code contains a number of laws referring to the adoption of children; and, from the large number of contracts discovered, it seems that adoption was extensively practised, especially by aged people, that they might be cared for. There are also a large number of laws in the code that refer to slavery and many documents dealing with the purchase of them.

In this connection reference might be made to the code's legislation for surgery and the practice of medicine, and also the many medical texts that have been found, most of which have come from the Library of Ashurbanipal. Not a few of the medical formulæ refer to headache. The theory of disease being largely that of demoniac possession, whenever headache attended a sickness the seat of the demon was considered to be in the head.

UNIFORMITY IN MEDICAL PRACTICE

This resulted in great uniformity in treatment. Salves or liniments, hot and cold, were used in rubbing the head. Fumes of drugs were allowed to play about the head in the hope that the demon would be driven out by the pleasant or unpleasant odors. Some of the drugs acting as counter-irritants, or soothing the nerves, doubtless many of the concoctions were found to be helpful by the physician, and were adopted as remedies by other peoples.

It has recently been shown that the terms for such substances as cossia, chicory, ammonia, cummin, and cynoglosson, occurring in medical treatises of the Greeks, are to be traced to the Babylonians.

The Code of Hammurabi fixed the charges of physicians and surgeons. If a physician cured a broken limb or healed a diseased bowel, his fee from the gentry was fixed at five shekels; from the commoner, three; and from the slave, two. The surgeon for an operation upon the upper class received ten shekels; the lower, five, and a slave, two.

HARD ON THE DOCTOR

In order to discourage the surgeon from making rash operations, severe penalties were fixed in case of unsuccessful one. If the patient died, the surgeon's hands were cut off. In the case of a slave, he had to replace him with one of equal value. If the slave's eye was lost, he had to pay half the value of the slave.

If the veterinary surgeon were successful, he received one-sixth of a shekel; but if the animal died, he had to pay one-sixth of its value.

There were a large number of literary inscriptions found in the library of Ash-

Photograph by Frederick Simpich

A FAIR BEDOUIN OF MESOPOTAMIA

The Bedouins claim Ishmael as their ancestor. It was of Ishmael that the Angel of the Lord said: "And he will be a wild man; his hand will be against every man and every man's hand against him."

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TILLING THE SOIL NEAR HARAN, NORTHERN MESOPOTAMIA

The Mesopotamian region has been famed for its agricultural products from the earliest times. Even today with almost all the ancient irrigation system in ruins, the rich black earth, when watered, produces in greatest abundance. In ancient times, under the proper irrigation, its productivity was the subject of comment by every writer.

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THE MOUND IN THE BACKGROUND IS THE REMAINS OF AN ANCIENT CITY

While many of the ancient sites of Babylonia have been identified, as Babylon, Nippur, Erech, Larsa, Ur, Lagash, etc., and have been partially excavated, hundreds in Babylonia and thousands in western Asia, with their ruin-hills practically untouched, retain their names as well as their secrets.

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A SECTION OF THE MIGHTY WALL, NOW COMPLETELY CRUMBLED, THAT ONCE PROTECTED NINEVEH

That wonderful region where the Garden of Eden was laid out, where the great civilizations of Assyria and Babylonia rose and fell, and out of which came the mighty hosts of Xerxes and Darius on their world-conquering missions, is again today one of the Armageddons of human history.

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THE SITE OF THE ROYAL CITY OF NEBUCHADNEZZAR

What seem to be eroded hills in the background of this picture are in fact the crumbled and age-covered ruins of the capital of King Nebuchadnezzar. The contrast of this picture with that on page 140 will show the "before" and "after" of the work of excavation.

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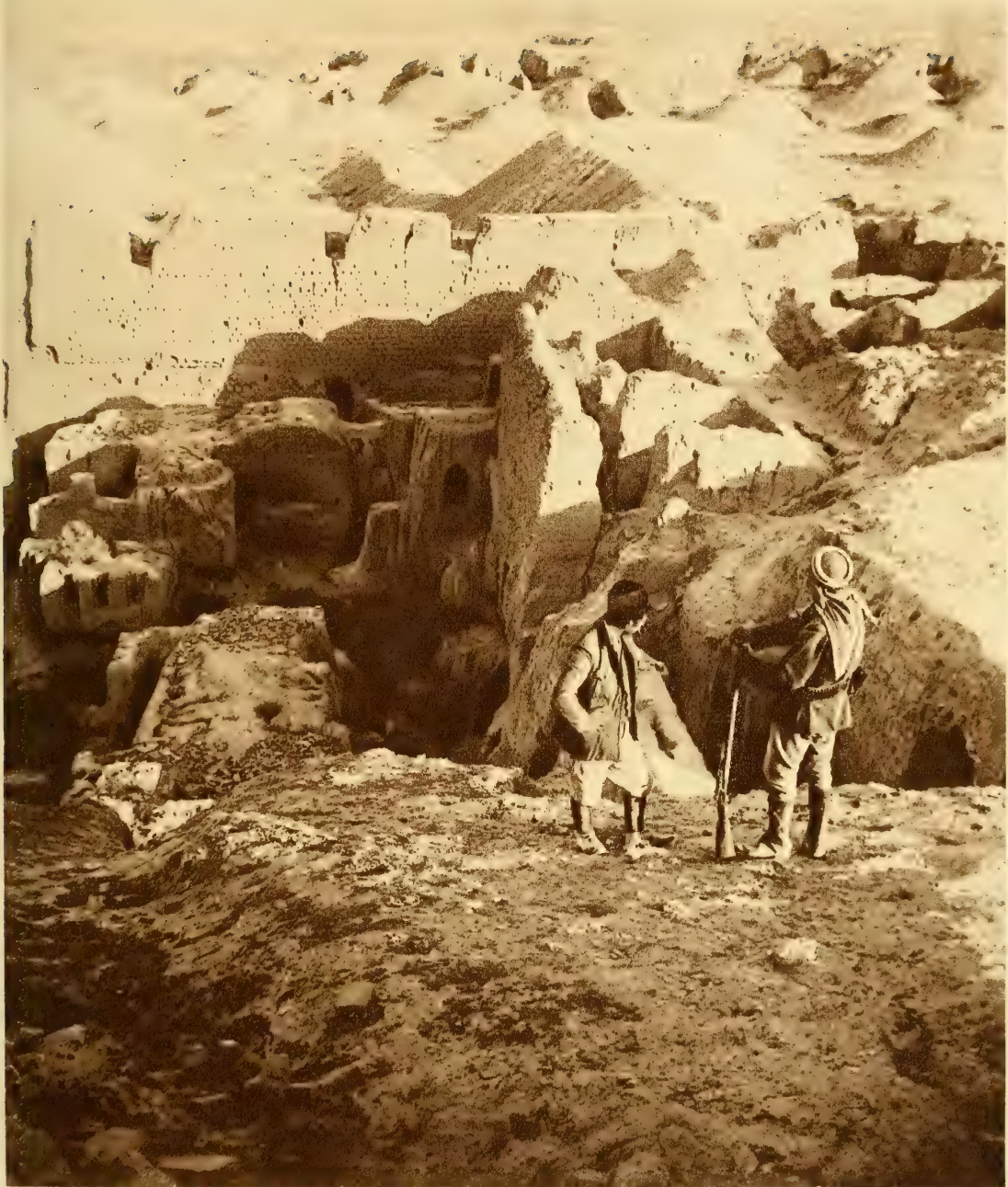
RUINS OF THE GOVERNMENT BUILDINGS OF THE GREAT CITY OF ASSUR, THE FIRST CAPITAL OF ASSYRIA

Just as in these latter days we put records of our times in the cornerstones we lay, so the Babylonian and Assyrian rulers were careful to preserve the records of their times. Will the distant future ever bring the time when men shall excavate the ruins of our cities as we in these days search those of long ago?



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THE ANCIENT CITY OF NIPPUR, RESCUED FROM OBLIVION BY AMERICAN EXCAVATORS

The problem of knowing where to begin digging in the exploration of an ancient city site cannot be solved; the student of ancient geography has to trust that far to chance. If, in his first excavations, he happens to dig into the ruins of some great public building of the ancients, his problem is very much simplified. This picture shows the work of excavation after the explorer has struck "pay dirt," so to speak.

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RUINS OF THE PARTHIAN PALACE OF CTESIPHON

This ancient town, now the centre of the Mesopotamian theatre of war, is on the Tigris, twenty-five miles below Bagdad. Herodotus says grain produced two hundred and even three hundred-fold in this region, and that blades of wheat were often four fingers wide. Either Herodotus got his information from the secretary of the Babylonian Chamber of Commerce, or else Mesopotamia possessed better farmers than any part of the world possesses today.

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VIEW FROM MOSUL ACROSS THE TIGRIS TO NINEVEH, MESOPOTAMIA

It is only three-quarters of a century ago that the first real exploration work was begun in Mesopotamia, under P. E. Botta, stationed at Mosul, as a French consular agent. The announcement of his discovery of a portion of an Assyrian building in Nineveh, filled with monuments of the past, created tremendous excitement. Since then, the pick and spade of explorers, French, German, British and American, and the patient toil of the decipherer, have thrown a flood of light upon the history of these ancient peoples, and the history of civilization has been carried back to 4000 years before Christ.

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JEWISH COBBLERS REPAIRING SHOES FOR ARABS NEAR MOSUL, MESOPOTAMIA

The wanderings of the children of Israel in the desert were no greater than those of their fathers. When Abraham was still a young man he journeyed with his father to Haran, where he dwelt for a period. From there he went into Canaan, only to be driven by famine into Egypt, from which place he later was banished. He went back to Canaan and famine again overtook his people in the days of his grandson Jacob, and once more brought them to Egypt, whence they were forced to return to Canaan a third time by the exactions of the Pharaoh who knew not Joseph.

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THE TOMB OF EZEKIEL AND THE TOWN OF KEFIL, NEAR ANCIENT BABYLON

There are four shrines in the Bagdad region to which the Jews of Mesopotamia make monthly visits—the tomb of Ezekiel in the village of Kefil, the tomb of Ezra near Korna, the tomb of Joseph, and the well of Daniel. The Jews bury here their chief priests, a right which the Moslems at times contest.

ASHURBANIPAL, THE LION HUNTER, ON HORSEBACK

Ashurbanipal, conqueror of Egypt, was one of the most enlightened of Assyrian monarchs. He had a great taste for literature, and in this respect we owe him an infinite debt. His scribes were commanded by him to make copies of the annals of Babylonia and Assyria from the libraries of all the most important cities in the land, and it is from these copies, made on clay tablets and preserved in the library of the king's palace, that the bulk of what is known of Assyrian and Babylonian history and religion has been learned.

THE ASSYRIAN CONCEPTION OF ASHUR, THE CHIEF OF THE GODS

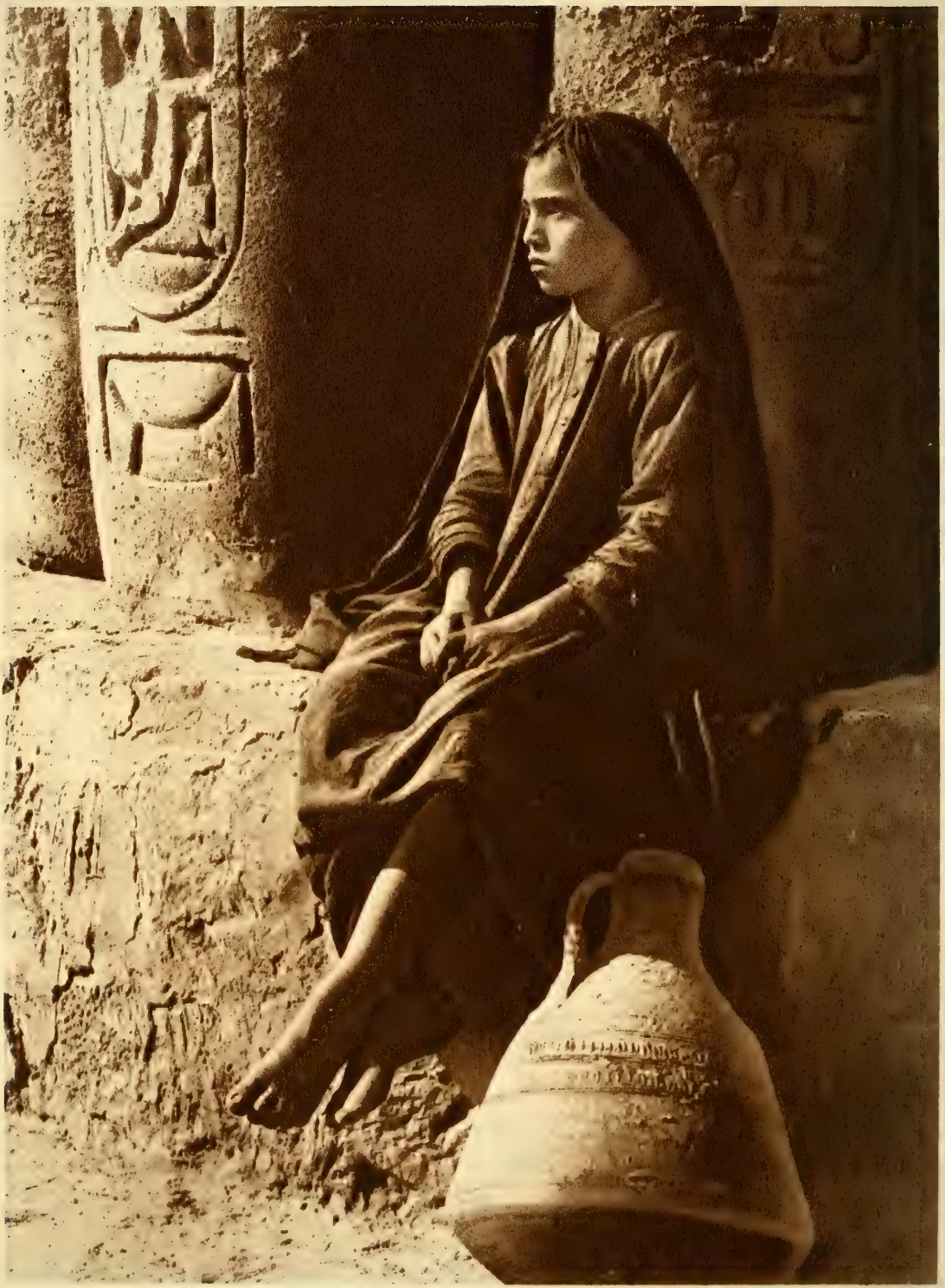
The Assyrians conceived their god to be an eagle-headed, winged deity going about with a basket in one hand and a pine cone in the other. One wonders whether the modern custom of wearing wrist watches did not come down to us from the equitation experts of Babylon. This image was carved about 4,000 years ago.

ASHURNATSIRPAL HUNTING LIONS IN HIS CHARIOT, NINEVEH

Many of the rulers of Assyrian Babylonia were proud of their prowess as hunters, and if their exploits were anywhere near as brave as their sculptors have depicted them, big game hunting in the 20th century certainly has not more excitement in it than it had in the days of the Ashur-pal line of kings.

A MARBLE SLAB SHOWING THE MUSICIANS AND ATTENDANTS OF ASHURBANIPAL

Music had its charms in ancient Babylon and Nineveh, and no kingly court was without its staff of musicians.



Photograph from Frederick Simpich

AN ARAB GIRL AT THE TEMPLE OF LUXOR ON THE NILE

The civilizations of Babylonia, Assyria and Egypt were closely related, and there was a constant interchange among their people, an example of which is the journeyings of the forebears of Israel from Mesopotamia to Canaan, into Egypt and back again.

urbanipal. Several mythological poems, besides fragments of others, were found, of which the seven tablets of creation are among the most important. Apsu and Tiamat, who represent the primeval watery chaos, were the first creators. They were followed by other generations of gods, whom they sought to destroy.

This resulted in the fight of Marduk with the primeval goddess Tiamat. He slays her and splits her in halves like a fish, half of which he uses to make a firmament to keep back the celestial waters, and the other half the earth to hold back the subterranean waters.

Another very important poem is that which recounts the deeds and adventures of Gilgamesh, an early ruler of Erech, about whose name these myths are associated. It was written upon twelve large tablets and found also in the library of Ashurbanipal. This version was copied from older originals, of which a large but fragmentary tablet is preserved in the Yale Babylonian Collection; and there is also a fragment in the Berlin Museum.

A BABYLONIAN "PARADISE LOST"

Other important mythological poems are the flight of Etana on the back of an eagle to heaven and his fall to the earth; the myth of Adapa, in which he failed to obtain immortality by refusing to accept food at the advice of the god Ea; Ishtar's descent into hades, etc.

A large number of hymns and liturgies have been found at various sites. At Tello, a few belonging to the early Sumerian period were discovered. At Nippur, Sippar, Erech, and Larsa many were found, chiefly belonging to the early period, about 2000 B. C.; at Erech and Babylon also some of a later period. By the help of these the history of Babylonian worship will be written.

At present the earliest known liturgies are written in Sumerian, but after about 2000 B. C. it generally became the custom of supplying the Sumerian texts with interliner's versions in the Semitic vernacular. Whether the excavations at some of the earlier Semitic centers in the northern cities will yield earlier original Semitic liturgies, and show that the Sumerians were indebted to these, remains to be seen.

Moreover, it is known that the psalmists among the Semitic Babylonians used the Sumerian liturgies in their service and continued to use them until the closing days of Babylonian history. In other words, Sumerian was the liturgical language.

A CONSCIOUSNESS OF SIN

A consciousness of sin prevades the liturgies of Babylonia. By the use of them the sinner desired to pacify the gods, who manifested their anger by bringing woes upon mankind. Through lamentations and sighings the penitent sought relief. It must be conceded that the Babylonian prayers were such that must have stirred the soul to its depths. The fundamental element of religions is therefore inherent in these liturgies.

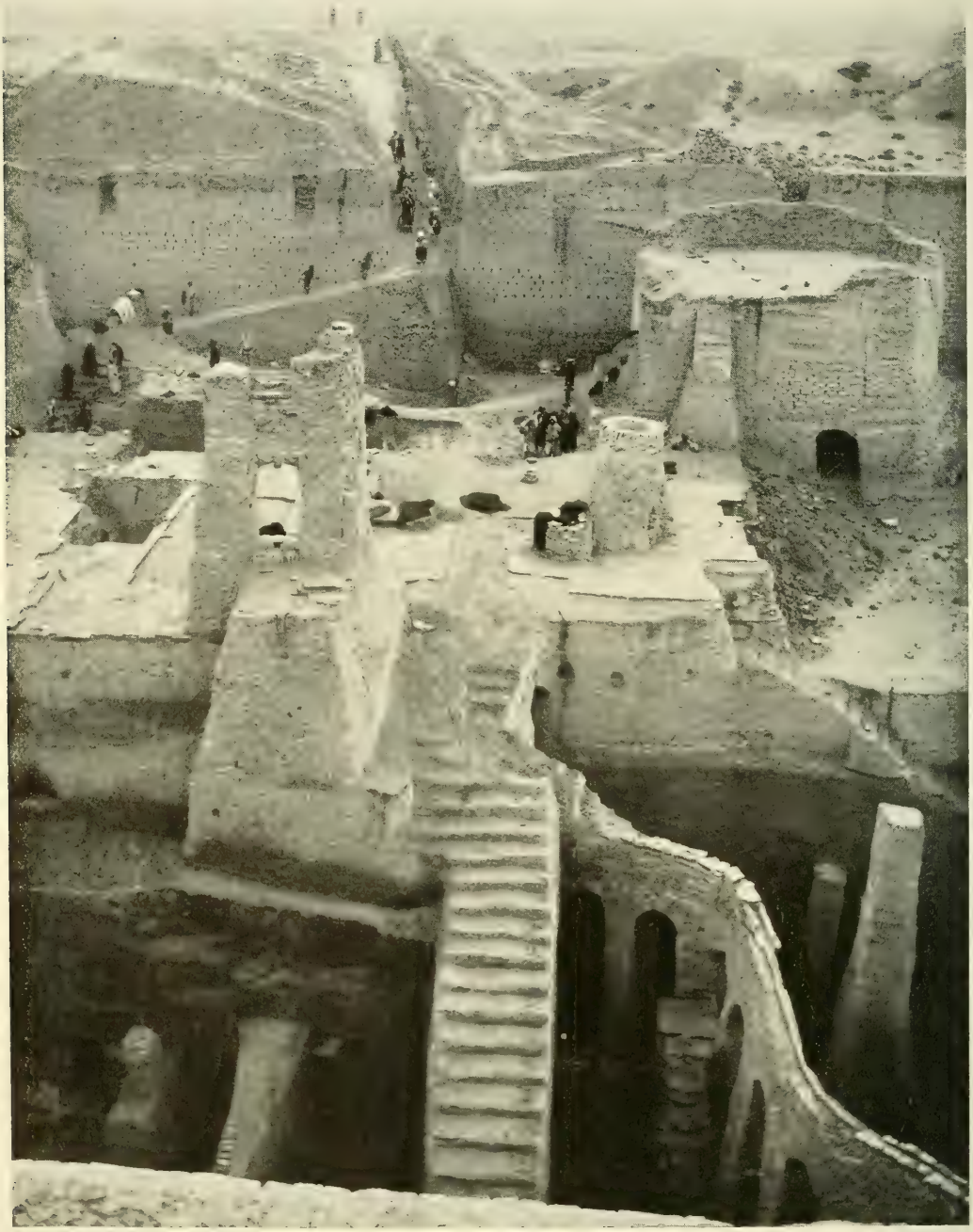
It has been pointed out that the Babylonian penitential psalms are similar in form to the Biblical. The contents and character, however, are quite distinct. We have in the Babylonian crude polytheism and practices of a natural religion, which, of course, is responsible for a different conception of the atonement sought for.

Another large body of temple rituals was the incantations or magic rituals by which the priests exorcised the evil spirits. These rituals were quite extensive in variety. There were, for example, the "burning" series, in connection with which, with charms, magical figures were consumed by fire representing the fever, the headache, the evil demon, the Labartu, or female demon.

READING THE SIGNS OF THE TIMES IN STARS AND LIVERS

These texts seem to emanate from the later periods, which would mean a degeneration of the higher forms of worship, exactly the reverse of what is found among other peoples. But whether other libraries, when excavated, will show that these crass religious expressions of man are older than the religious literature of a higher order remains to be seen.

A large number of texts have been found in the various libraries dealing



Photograph from Prof. Albert T. Clay

EXCAVATIONS IN THE TEMPLE AREA AT NIPPUR

The explorer of the future will be a digger rather than a hiker. The discoveries obtained by the pick and shovel are affording constant proof that the truth of history surpasses the fancy of romance, even though that romance may spring from the fertile imaginations of the people of the land of Harun-al-Rashid.

Photograph from Prof. Albert T. Clay

THE RUINS OF A LIBRARY BUILDING 4,000 YEARS OLD: NIPPUR

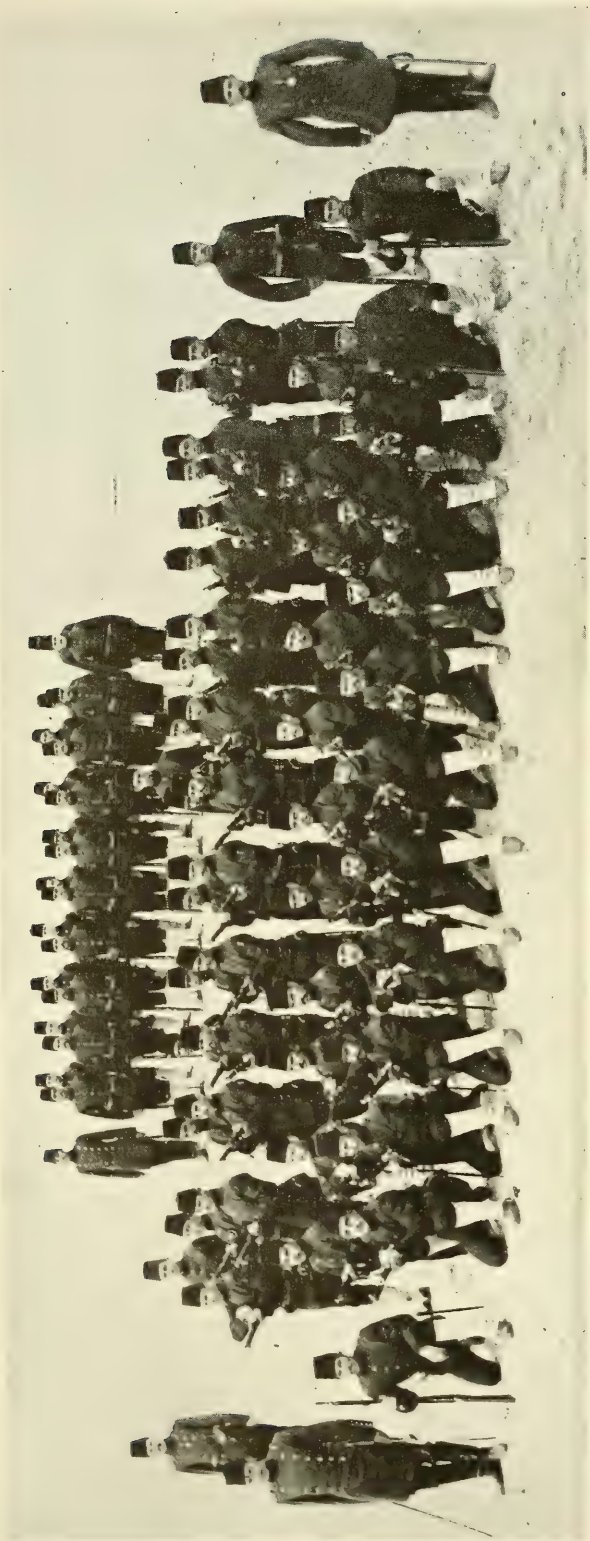
This library yielded to the pick and shovel of the explorer thousands of tablets written in days antedating the era of Abraham. More than seven hundred contract tablets were discovered in one building at a depth of 20 feet below the surface. The great care with which they had been made, the exceptionally pure and soft clay chosen, and the large number of fine seal impressions exhibited by them attracted the attention of the decipherer at once. Upon closer examination, they proved to belong to the business archives of a great Babylonian firm, Murashu Sons, bankers and brokers at Nippur, who lived in the time of Artaxerxes I and Darius II. This banking-house was to the Persian kings what the house of Rothschilds has been to England and that of Morgan to the United States.

with hepatoscopy and astrology, the two chief systems used by the Babylonian priest or "inspector" (baru)—that is, they divined the future by the inspection of the liver of the sacrificial animal and by the observation of the starry heavens.

The Babylonians, as also many other ancient and in fact even modern nations, believed that the liver represents the seat of the soul; and since, according to their notions, the soul included the mind as well as the heart, the inspection of the liver in the case of an animal that had become sacred by being offered to a deity furnished a means of ascertaining what the deity himself had in mind to do.

The observation of the heavens and the interpretation of unusual astronomical and meteorological phenomena also enabled them to determine the will of the deity. This method of divining seems to have been introduced into Babylonia later than liver divination.

One of the important results of cuneiform research is the new historical geography which has been reconstructed with its thousands of data. Hundreds of important cities have been identified among the partially inhabited or wholly deserted ruin hills of western Asia. An inscribed brick or a dated tablet, or perchance an inscribed cylinder found at a particular



Photograph from Frederick Simpich

TURKISH SOLDIERS: BAGDAD

Eighteen months ago many of these soldiers were Arab peasants, who knew nothing of military training

place, may have given the clue to the identification of the ancient city.

NEBUCHADNEZZAR DELVES INTO THE PAST

For example, on a cylinder found at Wana-Sedoum, now in the Yale Collection, which is one of several of its kind made by the royal scribe of Nebuchadnezzar (605-561 B. C.), the king recounts his restorations of various temples (page 183). In the closing lines he refers to his restoration of the temple of Lugal-Marada at Marad, a city which has not been hitherto identified, as follows:

"From distant days its old foundation stone no previous king had seen. Its old foundation stone I sought for, I beheld, and upon the foundation stone of King Naram-Sin, my ancient ancestor (who lived about 3750 B. C.), I laid its foundation. An inscription with my name I made and placed in the midst of it."

Recently there was also added to the Yale Collection an inscribed stone, written in the ancient script, which came from the same site as the Nebuchadnezzar cylinder, namely, Wana-Sedoum. It proves to be one of the stones of Naram-Sin which Nebuchadnezzar saw. It refers to the building of the temple of Lugal-Marada at Marad by a hitherto unknown son of Naram-Sin, namely, Libet-ili, who was then patesi of Marad. It reads:

"Naram-Sin, the mighty king of the four

Photograph from Frederick Simpich

TURKISH SOLDIERS OF BAGDAD

Note the strange head-dress of these soldiers. This "keffeya" is designated to protect the men from the fierce heat of the desert

quarters, the subduer of nine armies in one year, when those armies he overcame, and their kings he bound and brought before Enlil, in that day Libet-ili, his son, patesi of Marad, built the temple of Lugal-Marada in Marad. Whoever alters this inscribed stone may the god Shamash and Lugal-Marada tear out his estate and extermine his seed forever."

A THOUSAND SITES UNOPENED

Future maps of Babylonia will include the site of Wana-Sedoum, with its ancient name, Marad. The city is almost due west of Nippur, on the Euphrates, and a little south of west of Daghara. While many of the ancient sites of Babylonia have been identified, as Sippar, Babylon, Nippur, Erech, Larsa, Ur, Lagash, etc., and have been partially excavated, *hundreds in Babylonia and thousands in western Asia, with their ruin-hills practically untouched, retain their names as well as their secrets.*

Babylonia is covered with mounds of debris, the accumulations of millenniums. Mesopotamia, the ancestral home of the patriarchs, is completely dotted with these tells. And when we read in the historical inscriptions of the hundreds of sites which have not been identified, it is impossible even to surmise what marvelous revelations are in store when these ruin-hills are opened by the pick and spade.

Not long ago the Hittites were only known to us from the Old Testament. Now we know a mighty nation of Asia Minor sufficiently powerful to invade Babylonia a little later, 2000 B. C., and to be able to force Egypt later on, in the time of Rameses II, to make an inglorious treaty with them.

Not long ago Boghaskuei, one of its ancient capitals, with its ancient records written in cuneiform, was discovered (see NATIONAL GEOGRAPHIC MAGAZINE, February, 1910). Other sites are being excavated, and as a result the science of Hittitology is gradually being developed.

These Babylonian and Assyrian researches have had important bearings upon the Old Testament. It was largely the desire to secure inscriptions, by the help of which the historical value of the Hebrew Scriptures could be tested, that inspired many in the early years of these researches to support excavations.

EXPLORATION AND THE SCRIPTURES

Imagine the interest that was aroused when the first Assyrian inscription was deciphered, referring to events recorded in the Old Testament, or when George Smith announced that he had discovered among the tablets of the library of Ashurbanipal a portion of the deluge story which closely resembles the Biblical account.

Several creation stories have been handed down by the Sumerians and Babylonians. The one showing the greatest resemblance to the Biblical references to the creation in Genesis and in the poetical books was found in the library of Ashurbanipal. After depicting the conflict between Marduk, the god of light, and Tiamat, the primeval goddess of chaos, it says the heavens and the earth were created.

The Sumerian cosmology, found at Sippar, symbolizes the establishment of order out of chaos. Still another fragment of a creation story, written in Sumerian and found at Nippur, makes another goddess, Nintu by name, the creator.

ACCOUNTS OF THE FLOOD

Besides the eleventh tablet of the Gilgamesh epic found by George Smith, of the British Musuem, which contains the deluge story so closely resembling the Biblical account, several others have since been discovered. There is a Ninevite recension also in the British Museum and a fragment of an earlier copy.

Another, the oldest dated story of the flood, is in the library of the late J. Pierpont Morgan. It was written in the reign of Ammizaduga, a little later than 2000 B. C. This represents a god calling upon Adad, the weather god, to cause a destructive rainstorm, and Ea interposing in order to save the diluvian hero.

Several years ago a little fragment of another Semitic story was found in the University of Pennsylvania Collection, but more recently a Sumerian version, which makes Ziugidda of Shuruppak the hero of the flood.

It has been suggested that the Ziugidda tablet belongs to a series, fragments of which have been found, and that this series contained lists of kings who ruled before and after the deluge to the time that the tablet was written, indicating that perhaps it is a Babylonian history of the world.

Should this fragment prove to belong to such a series, it would be a striking parallel to the brief history of the world as found preserved in the Old Testament. An interesting feature of the tablet containing the reigns of kings is that a period of 32,234 years is claimed between the deluge and the last king of Isin, who lived a little before 2000 B. C. Just how many kings ruled in this period is not known. In the previous period, however—that is, between the creation and the deluge—Berosus (who lived about 300 B. C.) informs us ten primeval kings ruled for 432,000 years.

BIBLE STORY CORROBORATED

The Babylonian inscriptions have thrown a flood of light upon the patriarchal period. Although many modern critics have until recently declared the entire historical situation different from that found in the Old Testament, they are now forced to acknowledge it to be in strict accord with the many details gathered from the monuments. The actual personal existence of the patriarchs, however, is still held by these scholars to be completely disproved.

Other scholars, however, hold that, notwithstanding the fact that we have peered in vain for reference on the monuments to the patriarchs, inasmuch as all such details that we could expect to see corroborated have been in an almost remarkable manner, that there is every reason to believe that the patriarchs themselves were historical.

But not alone the patriarchal period thus receives new light, but so many archæological sidelights have been thrown upon the Old Testament that there is scarcely a page that has not been illumi-

nated by them. Yes; it can be said that additional chronicles of the kings of Judah and Israel can be gathered from the Assyrian and Babylonian monuments.

These archæological discoveries, moreover, while illustrating and substantiating the historical value of much of the Old Testament records, also give rise at the same time to new historical and literary difficulties. It is found that the traditional view of the Old Testament must be modified very considerably—a knowledge of which, however, does not disturb the conception of the Old Testament as a religious book.

A HUNDRED BABYLONIAN RULERS PRIOR TO ABRAHAM

To cite a single instance: the Biblical chronology of the creation, whether we accept the Septuagint figures and make it 5500 B. C. or the Hebrew at 4000 B. C., cannot be harmonized with that which we know at present. The Old Testament gives a genealogy of ten names covering 427 years, according to the Hebrew, and 1,307 years, according to the Greek version, between the deluge and Abraham.

In order to show that the period was longer, it is only necessary to mention that about one hundred rulers of Babylonia prior to Abraham are now known, and how many more will be restored to history in the near future it is impossible to tell.

The work of uncovering the ruin-hills of Assyria and Babylonia is only in its infancy. The spade and the pick have only begun to dispel the darkness which has shrouded the mounds of these lands. Hundreds of ruins remain unnoticed and unrecorded, because many are low and insignificant, and yet some of them contain right beneath the surface remains of a hoary antiquity. Destroyed in some early epoch, the city perhaps was never rebuilt. Surprise upon surprise awaits the explorer.

Photograph from Prof. Albert T. Clay

A GROUP OF ARAB WORKMEN RESTING, WITH THEIR BASKETS FOR CARRYING OFF THE DEBRIS AND THEIR PICKS AND SHOVELS

"These researches have resulted in astounding revelations. Israel, instead of being one of the foremost nations of antiquity, is now found to have been a small power which had thrived in the late pre-Christian centuries and had occupied a comparatively insignificant position among the great nations of its age" (see text, page 164).

THE BAGPIPER

These musicians go about with animal shows among the cities and villages and are the delight of the children

Photo by the American Colony at Jerusalem

A DESCENDANT OF ABRAHAM

About one hundred rulers of Babylonia prior to Abraham are now known, and how many more will be restored to history in the near future it is impossible to tell. History's horizon has thus been pushed back two thousand years within the lifetime of thousands of the readers of this magazine.

OUTLINE MAP OF THE WORLD'S MOST HISTORIC LANDS

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THE NATIONAL GEOGRAPHIC MAGAZINE

GREAT BRITAIN'S BREAD UPON THE WATERS: CANADA AND HER OTHER DAUGHTERS*

BY WILLIAM HOWARD TAFT

THE strain of the great war now raging is a test of the character of the peoples engaging in it, and of the institutions to which they have committed themselves and in behalf of which for decades and centuries they have labored. It places their ideas of government and their philosophies of the life in a crucible under the intensest heat. It is no respecter of preconceived theories, and it lays bare weaknesses that were not suspected. The war has shown a high spirit of patriotism and self-sacrifice as the common trait of all those engaged in it.

In England the war has betrayed the delays and blunders in the beginning of a war which it seems impossible to avoid in a parliamentary government.

England's course in this war has confirmed the view that if war is to be a normal condition of national and international life, popular government, with a free press and unrestrained public opinion, is not the best form adapted to act quickly and to overwhelm an enemy.

Its inherent disadvantage in the outset of a war is not only a reason why it should avoid war when it can do so with honor and without national sacrifice, but it is also a reason why it should in time of peace make every reasonable preparation for national defense consistent with individual liberty and the control of the people.

It is not true that popular government unfits a people for war, saps their unselfish patriotism, or dulls their willingness to make the sacrifice. The armies of France raised in the wars of the French Revolution refute any such notion. Our own Civil War shows that participation in government and the consequent sense of ownership in it prompt the highest spirit of sacrifice for the country.

Many counsels in a democracy may confuse or may prevent the needed concentration of power in one competent leader or body of leaders to produce wise and quick action, but the fault is not in the willingness or capacity of the citizens to make good soldiers. Training in popular government and traditional love of civil liberty stir the souls of men to costly conflict, even when their material interests and their opportunities for evading its sacrifices tempt them to withhold their aid.

THE LESSON WHICH THE AMERICAN REVOLUTION TAUGHT GREAT BRITAIN HAS BEEN WORTH ALL IT COST HER

We find such an instance in the conduct of the people of Canada, Australia, and South Africa, under the wise and generous treatment of them by Great Britain, their mother country, for half a century. It is a pleasure for a student of popular constitutional government to

*An address to the National Geographic Society, February 11, 1916

THE EMPEROR FALLS

What more inspiring sight than after hours of climbing over precipitous mountain trails and hearing the roar of falling waters in the distance to come suddenly into view of a waterfall like this? The little Grand Forks River, which pursues its tortuous way through the wild Mount Robson region of British Columbia, is a series of scenic surprises, not the least of which is this beautiful fall.

dwell upon this and trace out the reason for it.

It is possible for us, who are not involved in this war and who occupy a neutral position, to do justice to the noteworthy exhibition of admirable qualities in all the belligerents without exposing ourselves to the charge of partisanship or prejudiced sympathy; and it is with that attitude and from that standpoint that I invite your attention to the consideration of the vindication of England's policy in the autonomous governments under her, which constitute a part of her so-called empire.

Through the blindness of George III, and against the judgment of the more liberal statesmen of his reign, the American colonies were lost to England. That they had originally, all of them, a warm affection for the mother country and a pride in their relations to her is clear; that the course which George III and his ministers took in dealing with them was ill-advised and unjust and altogether lacking in prudence and tact, the modern English historians are now the first to admit; that the grievances of which the colonies complained were perhaps not as acute and oppressive as we have been taught in our school histories to believe may be true.

It suffices to say that, however weighty or otherwise those grievances were, they were at least enough to instil in the minds of a people who had enjoyed practice in self-government, through neglect of the mother country for 100 years, a vision of independence and a desire for it that, once developed, precluded the possibility of a resumption of British control. The lesson which the war of the American Revolution taught to Great Britain has been worth all it cost her.

OLD GRIEVANCES ARE NOT FORGOTTEN

The spirit of revenge in which we dealt with the Tories who were loyal to England in our struggle, and the confiscation and the suffering to which we subjected them, drove a body of people into Nova Scotia and into Upper Canada numbering 40,000. England sought by the appropriation of 3,000,000 pounds to salve the wounds of these United Empire loyalists. Their feeling of enmity toward the United States, handed down by tradition, has had a real effect to prevent the union of Canada with this country. Their attitude was confirmed in the War of 1812.

Under the Constitution of 1791, which divided Canada into two provinces, Upper and Lower, each had a legislature with a council which the legislature did not control, under a British governor. This system lasted for 50 years, but it proved unsatisfactory. A "family compact" of ultra Tories in the council ruled Upper Canada and defied and bullied the legislature.

In Lower Canada, where the French lived, England had, by the Quebec Act of 1774, satisfied their race and religious sentiment by assuring to them a continuance of their civil law and customs and the maintenance of the quasi-political status of their church. This prevented the French from joining the American Revolution and retained Canada for England.

A BRILLIANT STATESMAN

The promise has been faithfully kept. Still the constitutional act did not work well with the French any more than with the English. So it was that in 1837 the Frenchman Papineau in Lower Canada and the Scotchman MacKenzie in Upper Canada sought to overthrow their respective governments by force. These rebellions were easily overcome, but there remained for the home government the burdensome task of solving what seemed an insoluble problem of restoring peace and order among a dissatisfied people, half English and half French.

Lord Melbourne and his associates prevailed on the Earl of Durham to undertake the task. The selection was fortunate for Canada and fortunate for Great Britain, although the immediate result of his short incumbency was apparently a humiliating failure. Lord Durham was one of the great statesmen and the great radical reformer of his day.

He entered Parliament at 21, and long before they really became the burning issues he was advocating Catholic emancipation, a reform of representation in Parliament, extension of the franchise, and a repeal of the corn tax.

Photograph by Gilbert H. Grosvenor

A FAMILY OF NINE SONS: BADDECK, CAPE BRETON, NOVA SCOTIA

This family will soon be able to have a baseball team all its own. From Cape Breton Island have come many of the most loyal naturalized citizens of the United States. To our merchant marine on the Great Lakes this little island has probably contributed more captains and first mates than any other part of the world.

He was the son-in-law of the great Earl Grey and was the real draftsman of the great reform laws of 1832. He was hot-tempered, vain, impatient of criticism, and entirely unrestrained in the expression of his real opinions and in that diplomacy which would have given him far greater influence in the politics of his day. He was regarded by the people of England as their friend and representative, when the people were not as powerful as they are now. He was excluded from ministries because it was thought that no ministry could get along with him, however much their policies agreed in general outline with his.

When Lord Melbourne and Lord John Russell asked the Earl of Durham to go to Canada he was most reluctant to do so; but the ministry, Lord Melbourne, and others pledged themselves to back him in every way and gave him almost unlimited power to deal with the situation. When he reached there, he found it impossible to convict the rebels among Papineau's followers before a French jury, and finally they were induced to admit their guilt. He pardoned all but Papineau and a dozen others, against whom he entered a decree of exile to the Bermudas, with a penalty of death if they returned.

This disposition of the cases was well received in Canada and was approved in private letters of Melbourne and the other ministers. Lord Brougham, however, who was then in the House of Lords and the bitter enemy of Durham, contended that this was contrary to the British constitution and wholly beyond Durham's authority. He was supported by Lord Ellenborough. The ministry ignominiously deserted Durham, repudiated his action, and acquiesced in Brougham's demands. Durham at once resigned and returned to England after five months' service. The government studiously refused to give him the ordinary courtesies that a returning governor general was in the habit of receiving. His figure was a pathetic one. He was but 48 years of age, with an ability second to none in England; but his life seemed a complete failure and within two years he died—a broken-hearted man.

A REMARKABLE STATE PAPER

During his five months, however, he had seen clearly into the difficulties of Canadian government, and left a report which has been pronounced by high authority to be one of the greatest state papers in British history, and which really has been the basis of the highly successful policy pursued by Great Britain since in dealing with those peoples who have remained a part of her so-called empire, but who have inherited, because of their Anglo-Saxon origin, their love of popular government and of individual liberty.

He recommended that the Upper and Lower Canadas be governed by a single Parliament and with local self-government for each province, and he foreshadowed the union of all of the British provinces in North America. He urged the adoption of responsible government—that is, the executive control by the leaders of the majority in the legislature. He said: "The Crown must submit to necessary consequences of representative institutions, and if it has to carry on the government in union with a representative body, it must consent to carry it on by means of those in whom that representative body has confidence."

He said: "The constitution of the government, the regulation of foreign relations and of trade with the mother country and the other British colonies and foreign nations, and the disposal of the public lands are the only points on which the mother country requires control."

Local municipal government, in Durham's view, bore an important relationship to general government. He had noted the absence of adequate municipal institutions in Lower Canada. He said: "A general legislature which manages the private business of every parish, in addition to the common business of the country, wields a power which no single body, however popular in its constitution, ought to have—a power which must be destructive of any constitutional balance."

He thought that by establishing an adequate system of local government the general government would be relieved of those matters which are not its proper

Photograph by Mary Vaux Walcott

AN AVALANCHE IN THE CANADIAN ROCKIES

Opportunities for "snap-shotting" avalanches in action are not rare in the high mountains of western United States and Canada, but good photographs of them are. It requires an intrepid photographer to turn and calmly make a picture when the roar of great quantities of snow and rocks slipping down the precipitous mountain side is suddenly heard. Slightly to the left of the center in the picture above may be seen an avalanche on Mount Victoria, near Lake Louise, in British Columbia. In the foreground is the Victoria Glacier, to the surface of which this avalanche is falling from the top of the cliffs, 1,800 feet above.

Photograph and copyright by Underwood & Underwood

A TROOP OF NORTHWEST MOUNTED POLICE: REGINA, SASKATCHEWAN, CANADA

For individual bravery, dashing horsemanship, and general all-around ability for keeping order in unruly territory, the Canadian Northwest Mounted Police have established an efficiency record that would be extremely difficult for a similar organization to equal. Through their efforts there is a wholesome fear of the law in the most outlying districts, for the man who commits a crime in the most remote section of the wilderness feels sooner or later the hand of one of these troopers upon his shoulder.

concern. Moreover, by taking part in the responsibilities of local government, citizens would secure a training which would fit them for the better discharge of the duties of general administration.

In all these respects the report of Lord Durham was followed by the British Parliament in its Union Act of 1840. In one respect they did not yield to Durham's advice. Durham recommended the denationalization of French Canada, advocated the gradual substitution of the English for the French language, and the making of Quebec an English province by methods that would today be regarded as coercive. He thought this was essential for the strength of the colony as a British possession. The guaranties of the Quebec Act of 1774 were, however, not departed from.

The first Parliament of the United Canadas met in 1841. The act provided for a legislative council of 20 members and a legislative assembly of 84 members and gave to the two provinces (Upper and Lower Canada) equal representation in each body.

ALL THE CANADIAN PROVINCES BECOME UNITED

Under this act Canada proceeded to real self-government. Her legislature took complete control of the civil list in the post-office and freed her from all interference by the imperial government in all matters affecting her trade and commerce, including the previous imperial legislation which had imposed duties on goods imported from foreign countries into the colony and had prevented the free dealing between Canada and other nations.

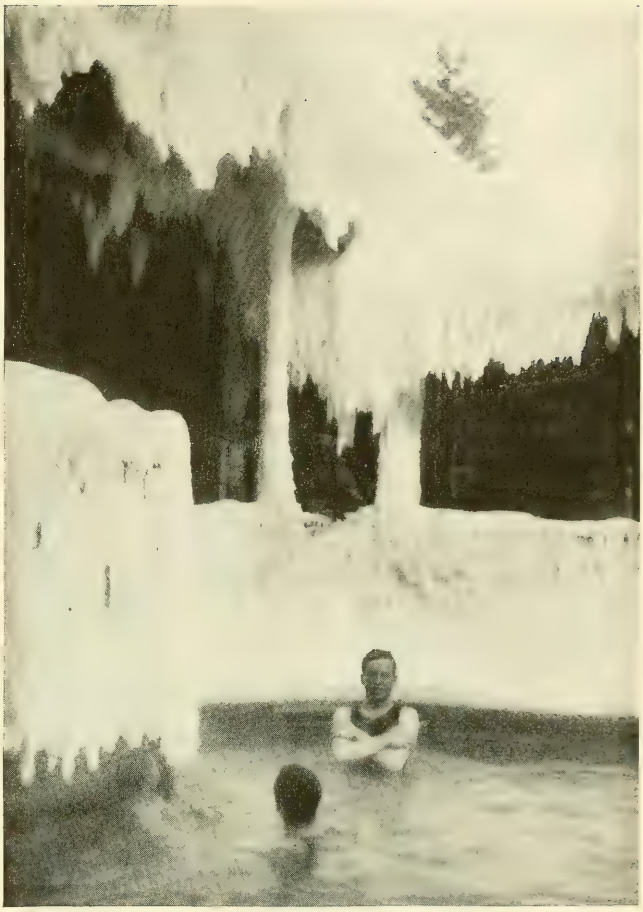
Lord Durham was succeeded by Lord Sydenham, and after him came Lord Elgin. These statesmen carried on the government under the Union Act with

REAPING WHEAT ON THE PLAINS OF ALBERTA, CANADA: THESE GREAT PLAINS ARE A CONTINUATION OF OUR OWN ROLLING PRAIRIES

marked ability and with very considerable success; but the growth of Canada was not responsive to the hopes of her people or of England, and it was conceived that a change was necessary looking to a closer union of all the British colonies of North America, including Nova Scotia, New Brunswick, and Prince Edward Island, as Durham had advised and foreseen.

One of the two parties adopted a platform of federation in 1858, but it took nearly ten years to carry the proposal to a successful issue. A convention for this purpose met at Quebec in 1864, consisting of 33 delegates. The convention sat for 18 days behind closed doors and left no official record of its deliberations.

The members had clearly in mind the Constitution of the United States and the history of that Constitution as a field in which they might find guides for their conduct. They represented both political parties, but in their deliberations they subordinated temporary political advantage to the patriotic purpose of reaching an agreement upon a government that should give opportunity for great national growth and development.



WINTER BATHING: BANFF, ALBERTA

Water sports under such conditions would suggest that all the comforts of home were conspicuous by their absence. However, the sulphur springs for which Banff is famous maintain a uniform temperature of 110 degrees throughout the year. Therefore, while the atmospheric temperature may approximate zero, the water is very warm and pleasant for the bather—who keeps below the surface!

The secret deliberations in such a crisis, as in our Constitutional Convention, led to the expression by the delegates of their real convictions; shortened the debates, because they did not talk for buncombe, and brought in the short space of less than three weeks a solution of what had seemed a very difficult problem.

The men who most contributed to this end were John A. McDonald, George Etienne Cartier, and George Brown. While Cartier and McDonald had been together as political associates, they represented different elements, Cartier being a representative of the French Canadians and McDonald a representative of the English and Scotch conservatives, while Brown represented the liberal English and Scotch voters.

The success in its way was as notable as that of our own Constitution, in the wise compromises that were effected and in the sacrifices of personal opinions and notions that the compromises necessitated.

The successful launching of the new government proposed was attended with difficulties. The smaller provinces of

Photograph by Gilbert H. Grosvenor

VIEW OF THE BRAS D'OR LAKES, NEAR BADDECK, CAPE BRETON

Photograph from Lieut. W. K. Harris

TIMBER FROM THE SLOPES OF MOUNT WARNING: NORTH COAST DISTRICT, NEW SOUTH WALES

Conservation of forest resources is a problem which has long confronted the governments of the various Australian States, for the early settlement of the more heavily timbered regions was characterized by a waste of much valuable timber. This problem has been well solved, however, by establishing numerous State forests, administered in very much the same way as our own national forests.

Photograph from Government Publicity Department, Sydney

GEORGE STREET, SYDNEY, NEW SOUTH WALES, SHOWING TOWN HALL

Sydney, the metropolis of New South Wales and likewise its capital, is an English city, although on every hand there may be seen American goods advertised for sale. This city, the oldest in Australia, was founded by Capt. Arthur Phillip in 1788 and is the continent's principal naval station. The deep water of its beautiful and nearly landlocked harbor is almost without shallows up to the edge of its rocky shores. With the possible exception of Melbourne, Sydney is the most important commercially of any of the British ports of the South seas. The city is in a particularly picturesque spot and notable for the many handsome public buildings, parks, and gardens, which, together with its wide, clean streets, give it the appearance of one of the more attractive European capitals.

Nova Scotia and New Brunswick were loath to accept the government proposed and were only brought in by an agreement that a railroad should be built connecting Halifax with Quebec. It is an interesting and somewhat singular fact that the later union of the far western provinces with the Dominion was also conditioned upon the establishment of communication by railway between Ontario and Quebec and the Pacific coast.

The statesmen and Parliament of the mother country assisted in every way the adjustment of the differences that arose in creating the Dominion and embodied in the British North America Act the result of the Quebec Conference. Prince Edward Island was incorporated in the

Photograph from Paul Thompson

GRADING HEMP: NEW ZEALAND

The manufacture of hemp from the fiber of the native flax can hardly be called a new industry in New Zealand, for her people have been trying it for at least thirty years. Their product has had an uncertain place in the world's market, however, for it is used as a substitute for manila, and when the price of that commodity was low New Zealand hemp was almost unsalable. In late years a great deal has been done to improve its quality and a market has been created for it. Much of it is sold to be spun into binder-twine, and the Japanese are said to be able to imitate silk with it.

Photograph from Lieut. W. K. Harris

CLEARING THE MALLEE SCRUB LANDS BY "ROLLING-DOWN" PROCESS: AUSTRALIA

When the brush is dry it is burned, and the land is then ready for plowing. "Mallee" is an evergreen shrub which grows as a short-stemmed bush in five or six shoots from one stump and reaches an average height of 12 to 20 feet. The trunk is seldom much thicker than a man's wrist, and it can hardly be called a tree, but it spreads with extraordinary closeness.

Photograph by A. Nielen

PET KANGAROOS: MELBOURNE, AUSTRALIA

Australia, which is the largest island or the smallest continent, depending upon how one desires to refer to it, is the habitat of many curious animals, the best known of which perhaps is the kangaroo. The weight of this strangely constructed animal is upward of 200 pounds when full grown, and in past ages scientists tell us was two or three times as large. One of its peculiarities is a pouchlike fold of the skin in which the female can carry her young. This, however, is not entirely confined to the kangaroo, but is a part of the equipment of about two-thirds of the mammals of Australia. There is a curious disproportion between the forward and rear quarters of the kangaroo, the fore feet and legs being very small and the hind legs of enormous size and strength. With these latter, assisted by a huge tail, the kangaroo makes its way by means of tremendous leaps across the grassy plains, where in earlier days it was found in great droves.

union in 1867. The British North America Act offered an opportunity for the western provinces to come in as the Dominion government should permit and require.

WHEREIN THE CANADIAN CONSTITUTION DIFFERS FROM OURS

The framers of the Constitution of Canada thought it an improvement on the Constitution of the United States, in that the defects which the latter was supposed to have shown in the Civil War were corrected. Sir John McDonald in his opening remarks at the Quebec Conference said of the situation when our Constitution was framed:

"There were 13 individual sovereignties, quite distinct the one from the other. The error at the formation of these constitutions was that each State reserved to itself all sovereign rights save small portions delegated. We must reverse the decision by strengthening the general government and conferring on the provincial bodies only such powers as may be required for local purposes."

I think it is the general opinion now

that this view of the Constitution of the United States was a mistaken one. The adoption of the 13th, 14th, and 15th amendments strengthened somewhat the restraint upon State legislatures enforceable in the Supreme Court of the United States, but generally the division of power between the States and the general government remained the same.

And yet, as our Congress has exercised powers which she always had, but which she had not before exercised, the strength of the central government is seen to be quite all that it ought to be. There is danger that a great widening of the field of Federal activity and a substantial diminution of State rights would in the end threaten the integrity of our Union instead of promoting it.

However, the Quebec Conference, fearing secession, took the other view, followed MacDonald's recommendation, and agreed that in the division of powers between the Dominion government and the provincial governments the residuum should be in the Dominion government, and not be reserved either to the provinces or to the people, as with us.

The Dominion Parliament is made up of a Senate composed of Senators appointed by the government for life and of a popular House of Commons.

Another very great difference between our Constitution and that of Canada is that, while the guaranties of civil liberty in our own Constitution are all express, as insisted on by Jefferson and Madison, though not thought necessary by Hamilton, they find such sanction as they have in the unwritten British Constitution, and are left not to the courts, but to the protection of an executive veto of provincial or dominion legislation. This really gives an opportunity for much more radical legislation in Canada with reference to vested rights than we have in this country. This may not be so important now as it will be later, when a revulsion against the danger of corporate political control and a plutocracy, which is likely to threaten Canada in the future, shall give rise to not only needed regulation and restriction, but also to such excessive and indiscriminate attack upon capital investment such as we have seen in some parts of this country.

AUSTRALIA LIKED OUR CONSTITUTION BETTER THAN THE CANADIAN

It is a noteworthy significance that when the Australian Commonwealth was formed by the union of the various Australian States or provinces, about 1900, the Constitutional Convention followed more closely in the division of powers between the government of the Commonwealth and its associated and constituent States the principle of our Federal Constitution.

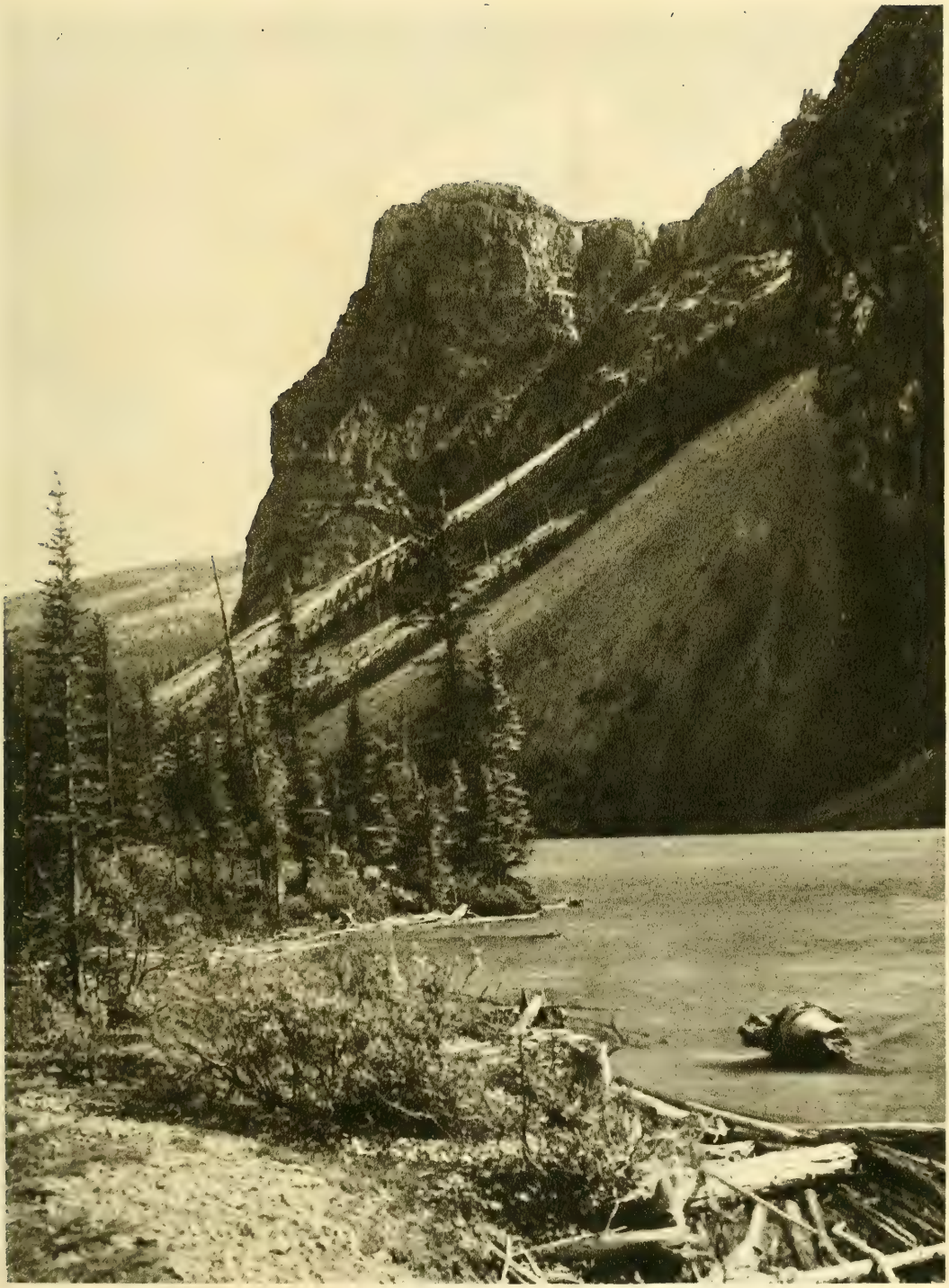
In other ways that Commonwealth followed our fundamental law more closely than Canada. Its Senate is made up by the equal representation of all the constituent States, and in the reserving to the States and to the people the residuum of power; so that the grants of power to the Federal government in Australia are to be construed as they are construed in our Constitution.

The framework of the fundamental law of Australia is based more on popular control than is that of Canada, and it is more independent of the mother country, in that the construction of its Constitution in the matter of the distribution of powers between the States and the Commonwealth is left to the Supreme Court of the Commonwealth, without a right of appeal to the British Privy Council except upon allowance of the Supreme Court, while in Canada a right of appeal in such cases is absolute.

SOME DIFFERENCES IN THE GOVERNMENT OF CANADA AND AUSTRALIA

A reason for the difference in the constitutions of Australia and Canada is doubtless found in the fact that the Canadian Constitution was adopted during the Civil War, when our Constitution seemed to have failed in securing power enough to the central government; and the Australian Constitution was adopted at the beginning of the 20th century, when our Constitution had shown itself able to weather the storms of secession and to authorize a central government continually increasing in strength with the growth and settlement of the country.

The difference in the manner of selecting the Senate, which in Canada, as



Photograph by Mary Vaux Walcott

TOWER OF BABEL, MORAINE LAKE, ALBERTA

Moraine Lake is reached by a drive of ten miles from Lake Louise. It nestles in the Valley of the Ten Peaks, at the base of the chain of mountains that give the valley its name. The Tower of Babel is a cliff at the north end of the lake, the higher mountains extending towards the southwest.

Photograph by Mary Vaux Walcott

MOUNT ROBSON FROM THE NORTH

The stream in the foreground flows into the Frazier River, and so on to the Pacific, while that behind the camera finds its way into the arctic watershed. A good trail leads from Robson Station to this point.

Photograph by Mary Vaux Walcott

BLUE, OR TUMBLING GLACIER, FED FROM THE VAST SNOW SLOPES OF MOUNT ROBSON

The tongue of the glacier as it is pushed down into the lake breaks off in numberless bergs, at the arch, thus giving the name—Berg Lake. The ice arch is very large and perfect.

Photograph by George Vaux, Jr., and Mary Vaux Walcott

LAKE LOUISE, ALBERTA

The varied coloring, as well as the perfect surroundings of this wonderful lake, cause it to have an absorbing interest for the traveler who has the good fortune to visit it. Mount Victoria (altitude 11,355 feet) in the background is four miles distant as the crow flies, but the thunder of the avalanches of ice can frequently be heard at the Châlet. The altitude of Lake Louise is 5,670 feet.

GIANT STEPS IN PARADISE VALLEY, ALBERTA

Paradise Valley is easily reached from Lake Louise over a good trail. Mount Temple towers above it on the right, while at the end of the valley Mount Hungabe lifts his majestic head to a height of 11,000 feet.

Photograph by George Vaux, Jr., and Mary Vaux Walcott

THE TWIN FALLS IN THE YOHO VALLEY, FIELD, BRITISH COLUMBIA

The Twin Falls are about 600 feet high, the stream feeding them draining the Upper Yoho Valley, which has several glaciers on the mountain slopes above it. The park-like valley, with its beautiful trees and carpets of flowers, and the high mountains and glaciers surrounding it, is a wonderful place for the camp of the alpinist.

Photograph by George Vaux, Jr., and Mary Vaux Walcott.

THE TAKAKKAW FALLS, IN THE YOHO VALLEY, NEAR FIELD, BRITISH COLUMBIA

These falls are fed by the melting of the glacier above, which is one of the numerous glaciers flowing from the great Waupetek snow field. The entire descent is about 1200 feet.

Photograph by George Vaux, Jr., and Mary Vaux Walcott

MOUNT LEFROY AND LAKE LOUISE

An early snowstorm in September enhances the fascinating beauty of Mount Lefroy and Lake Louise.

HAYLANDS, NORTH OF SMITHERS, BRITISH COLUMBIA, WITH HUDSON BAY MOUNTAIN IN THE BACKGROUND

Photograph by George Vaux, Jr.

ACROSS THE VALLEY OF THE KICKING HORSE RIVER, FIELD, BRITISH COLUMBIA

The mighty pyramids of the Van Horn Range in the background, their ruddy slopes streaked with snow.

Photograph by George Vaux, Jr.

RISING MISTS IN THE VALLEY OF THE KICKING HORSE RIVER, FIELD, BRITISH COLUMBIA

The shoulder of Mount Stephen on the right. Kicking Horse River was so named in 1858 by Sir James Hector, one of the foremost explorers of the Canadian Rockies, who, while journeying down the valley of the Beaverfoot River, arrived at its junction with a large and unknown river. Owing to a serious accident which occurred at this point and nearly cost him his life, due to a horse falling and kicking him, the newly discovered river was named "Kicking Horse" to commemorate the incident.

Photograph from J. C. Grew

THE PRIDE OF NEW ZEALAND

Due to its remarkable area of grazing lands and the introduction of English grasses, sheep raising is the great industry of New Zealand. Probably no other country on earth of equal size approximates New Zealand's record in sheep grazing, and its principal export is wool. As the flocks grow, however, the pelts change, and today there is much less merino and much more of the coarser and long-bred wool developed for market. The value of New Zealand's annual wool production is about thirty-five million dollars.

Photograph from Lieutenant W. K. Harris

A DAIRY HERD IN NEW SOUTH WALES

Dairying has made remarkable strides throughout New South Wales, and takes rank as one of its great industries.

Photograph by George F. Hammond

MOUNT ASSINIBOINE, THE AMERICAN MATTERHORN

Remarkable as one of the most beautiful of the Canadian peaks, Mount Assiniboine, first ascended in 1901 by James Outram, towers 11,860 feet into the clouds near the boundary between British Columbia and Alberta, about twenty miles south of Banff. Rising in a great pyramid to the sky, Assiniboine much resembles Switzerland's pride, the Matterhorn, although Mont Blanc is even more its prototype, and the similarity becomes at once apparent to the observer. This giant tooth of the Canadian Rockies was named for an Indian tribe of that region.

Photograph from R. P. Getty

VILLAGE GOSSIPS, CANADA

Photograph by Mary Vaux Walcott

ILLECILLEWAET GLACIER, BRITISH COLUMBIA

The Illecillewaet Glacier is easily reached from Glacier, British Columbia, over a beautiful trail one and three-quarter miles from the railroad. The ice fall is very picturesque, and in this view the characteristic blue bands are shown, as well as the seracs, with their separating crevasses.

already said, is by appointment of the existing government for life, while in Australia it is by election for a term, is explained by the more democratic spirit in Australia, and also because of the citizenship of two races in Canada, while in Australia the people are homogeneous and all English.

In Canada there was doubt as to who would possess the greater voting power as the country grew, the English or the French. This situation was thought to require a conservative Senate, which would mitigate the power and possible injustice and prejudice of the popular majority of either race.

The fact, too, that the constituent States in the Australian Commonwealth had long exercised independent and separate power, and naturally leaned toward a retention of as much power in the separate States as was consistent with an effective Commonwealth, reproduced the situation which existed at the time of the framing of our Constitution.

On the other hand, in Canada, when the Dominion was formed, the dominant States or provinces of Quebec and Ontario had been united under a complete and all-inclusive government by a single legislature since 1841.

In the case of Australia, it should be noted that the making of the Commonwealth was not left only to delegates, as in the Quebec Conference, but was confirmed by referendum to the people of all the constituent States—a procedure indicating the greater insistence upon the rule of the people among the Australians.

THE CONFEDERATION OF SOUTH AFRICA

Some ten years after the formation of the Commonwealth of Australia the South African Union was formed. In creating this, the conditions calling for the union were quite different from those which had existed when the Dominion of Canada and the Commonwealth of Australia were established.

In South Africa the British domain included Cape Colony, the Orange Free State, the Colony of Natal, and the Colony of Transvaal, together with an extensive hinterland. The bitter and bloody conflict in the Transvaal War had naturally left a condition which required care in the making of the new government and presented different problems from those of Canada and Australia.

It was necessary to strengthen much the central government at the expense of the federating States. Indeed, the breadth of the powers of the central government in South Africa, as compared with those of the Dominion or Commonwealth, is so great that accuracy in calling the South African Union a federation at all may be questioned.

The central government has a general grant of power "to make laws for the peace, order, and good government of the Union." No other power is conferred, and this is because any subsequent enumeration of powers would have only weakened the grant.

The powers of the constituent provinces hardly exceed those that might be granted to a county council in England or to a general municipal corporation in this country. There is equal representation of the provinces in the Senate and a popular district representation in proportion to the electorate for the lower house.

The powers of the executive are much enlarged because of the presence within the jurisdiction of a large number of native races. The Union government today has under its control 5,000,000 natives within the territory of the States making up the Union, and outside of the States 2,000,000 more.

In spite, however, of these differences in favor of the power of the central government, the government is a popular one, and representative directly or indirectly of the people.

In all these associated British governments of which I have been speaking—in Canada, Australia, and South Africa—an independent judiciary like that of the mother country has been provided by appointment of the executive and a tenure for life. In this respect the new State-makers wisely followed the British and our Federal Constitution.

ALL THESE NEW ENGLANDS ORIGINATED WITH THE PEOPLE

The first fundamental fact that we note in the organization of these govern-

Photograph from Lieut. W. K. Harris

CABBAGE TREES ON THE SOUTH COAST OF NEW SOUTH WALES

The British first occupied Australian soil when, in 1788, Arthur Phillip, a captain in the Royal Navy, arrived in Botany Bay with eleven ships, bringing 750 convicts. These convicts had been sentenced to transportation from England, and were brought to Australia because the American Colonies, having just become independent, could no longer be utilized as a dumping ground. Finding the shores of Botany Bay unsuited to the requirements, Captain Phillip went further up the coast and established his settlement where Sydney now stands. This system of transportation continued until 1868, when the last Australian State refused longer to allow it. The convicts, men and women, were used as laborers by the freeholders.

Photograph from Lieut. W. K. Harris

FAIRY DELL FALLS, IN THE BLUE MOUNTAINS OF NEW SOUTH WALES

We are accustomed to associate glaciers and perpetual snows with mountain ranges, but in all the mountains of Australia there is no such thing as a peak capped with perpetual snow, and there is not one single glacier in all the land.

ments is that their formation originated with the people, and that they are popular governments; that while the framework of each was the subject of discussion with the home ministry in Great Britain, Parliament did not pass the acts which gave them legal life until they had the full consent of the people of each of these nations—for nations they are.

No pressure was brought by the mother country to amend in any substantial way the constitutions suggested. A practically complete autonomy has been recognized and encouraged by the home government in all these New Englands.

The union of the separate States into these federations has reduced the powers of interference or control of the home government which it had with the separate States which were being federated. Indeed, those powers have been minimized quite beyond the recommendations of the Earl of Durham.

The foreign trade of these New Englands is for their independent judgment. Protective tariffs are permitted even against England, and separate reciprocity agreements with other countries have been put in force. While the mother country must in the nature of things retain some control over their foreign relations, the practice has been in all diplomatic negotiations which concern them to allow them a representative in the negotiations. This was the case in the Joint High Commission to consider the differences between England and the United States growing out of the Civil War, in 1871, when Sir John MacDonald was one of England's representatives, and the practice has continued ever since.

There have been times in the history of Canada when there was a decided bent on the part of some elements in the population toward annexation to the United States or independence. With the ex-

Photograph from Lieut. W. K. Harris

CLIFFS OVERHANGING NATIONAL PASS, IN THE BLUE MOUNTAINS, NEW SOUTH WALES

Geologists tell us that the continent of Australia is one of the oldest existing land surfaces, having been good dry land when much of what is now Europe and Asia was still under water. Its mountains are low, mere worn-off stumps, it would seem, for the greatest peaks are only about 7,000 feet high. In the interior the scenery becomes rather monotonous because of its flatness, but in the mountainous country, which follows the general direction of the coast-line, wonderful views, full of color and variety, are to be had upon every hand.

ception of a small but vociferous faction in Quebec, this feeling has entirely disappeared.

In South Africa there had been, as a condition, the Transvaal War and the objection of the Dutch colonists to English control. That was solved by the war and by the statesmanlike dealing with the question under Lord Milner and others since that time; so that now, in a marvelously short period, and because of the generous and just dealings of England with the dissentient Dutch element, a desire to separate from England has been confined to a comparatively few, if we can judge by the insignificance of the rebellion headed by De Wet since the war began.

GREAT BRITAIN IS NOW REAPING HER REWARD

England has levied no taxes, has required from these dependencies, if they may be called such, no contribution to the heavy cost of the imperial defenses of herself and her New Englands and her other dominions. Whatever has been done in the way of the construction of a navy by Australia and whatever has been proposed to be done by Canada in this regard have been entirely voluntary.

Photograph from Government Publicity Department, Sydney

MARTIN PLACE, IN SYDNEY, NEW SOUTH WALES

This Sydney street reminds one of Michigan avenue, Chicago, and the resemblance is carried still further by a similarity in the personality of the two cities. The same enterprising atmosphere prevails in this Australian metropolis as exists in our own city at the foot of Lake Michigan. Sydney, the capital of New South Wales, and Melbourne, the capital of Victoria, vie with each other for commercial supremacy, and in each of them live nearly one-half of the people of its State—a fact that is deplored by Australian economists, who believe that there should be less congregating in cities and more settling upon the land.

A COLLIERY IN NEW SOUTH WALES

Australia is rich in natural resources, and not least among them is coal. This product forms one of the most valued yields of New South Wales, the total area of carboniferous strata in this State being estimated at about 24,000 square miles. Much of the coal is shipped from the city of Newcastle, an important commercial center, on Port Hunter, about a hundred miles by rail north of Sydney. This city has excellent wharfage facilities and the docks extend along the shore for nearly three miles. Its total tonnage of exports in a given time frequently exceeds even that of Sydney itself.

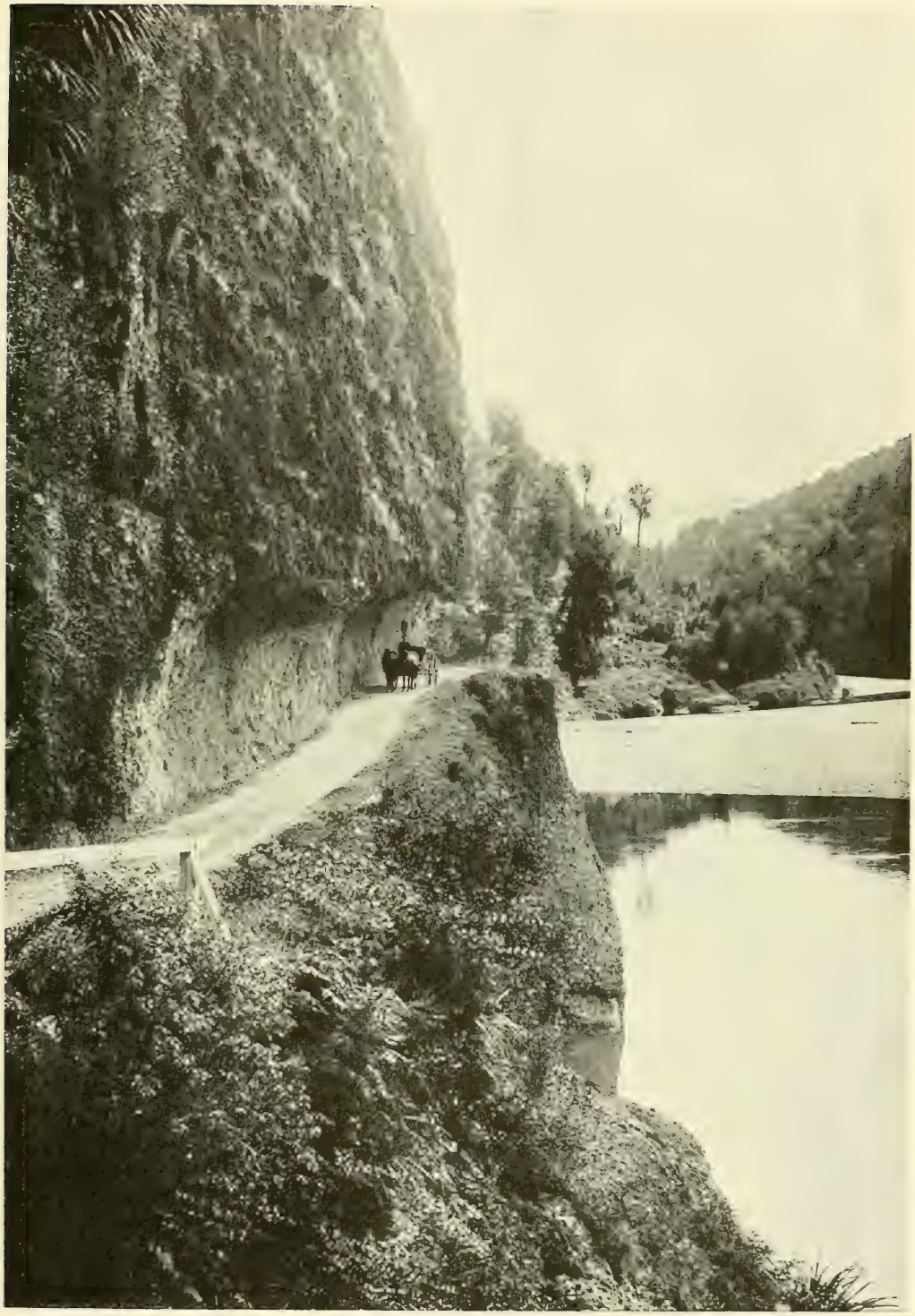
The truth is that it is hard to imagine a relationship between a mother country and peoples who recognize allegiance to that mother country under which the mother country could exercise less real control than under the three governments which I have thus inadequately described.

Of course, in each the King has been represented by his Governor General, and in each there is some power, but rarely used, to veto legislation on imperial grounds. There is, as already said, an appeal to the Privy Council—absolute in the case of Canada and the South African Union, but qualified in the Australian Commonwealth.

Chastened by her experiences in the war of the American Revolution, learning in her dealings with her people and their government in the furthermost parts of the earth how to promote their happiness and thus to treasure their love, Great Britain is now reaping her reward.

Canada has sent abroad 125,000 troops to reinforce the British army and has 125,000 more ready to go. The proposal now is to increase this number—and it will probably be carried out—to 500,000 men, or one-sixteenth of the entire population of Canada. Canada is spending over $1,000,000 a day in support of this military policy.

She has existing heavy obligations incurred in the construction of railways by



Photograph from J. C. Grew

A ROADWAY CUT OUT OF SOLID ROCK IN BULLER GORGE, NEW ZEALAND

New Zealand has glaciers, waterfalls, and volcanic peaks without number. Mineral springs and pools of water of every temperature, from ice-cold to boiling-hot, together with geysers and mud volcanoes, abound, and these, beside providing unusual scenery, furnish the location for many health resorts.

Photograph from New Zealand Government Tourist Department

THE REMARKABLES: LAKE WAKATIPU, NEW ZEALAND

South Island, New Zealand, is the Switzerland of the South Seas, for in its interior tremendous mountain ranges pile one upon the other until the lofty peaks thrust their snowy crests through the very clouds. Lakes there are in profusion, very deep and of vivid hue. The rivers are mountain torrents and on the island's southwest side there are more than a dozen deep fiords which bring the sea almost into the heart of this rugged country. This island is less than 200 miles wide at its broadest place, and Mount Cook, a little over 12,000 feet, is its highest point.

Photograph from New Zealand Government Tourist Department

ANOTHER VIEW OF LAKE WAKATIPU AND THE REMARKABLES: QUEENSTOWN, NEW ZEALAND

Country life in New Zealand is described as delightful. The solitude of early colonial days has now practically ceased to be continuous except in the few scattered outposts, and the country is becoming filled with capable, independent farmers. Where in other days attention was only given to securing the very necessities of existence, much is now being done to beautify the homesteads, and, even though the farmer's house may be only a cottage, it is now likely to be vine-covered, with a garden and orchard to be proud of.

Photograph from Government Publicity Department, Sydney

ON THE ROAD TO TWEED HEADS: NORTH COAST, NEW SOUTH WALES

The climate of the southern part of Australia is for the most part ideal, the thermometer varying not much more than 20 degrees throughout the year. In summer there is an average temperature in New South Wales of about 72 degrees and in the winter months about 52 degrees. Its rich soil is well watered and, assisted by the even temperature, the valleys and lowlands are covered with a luxuriant herbage.

Photograph from Lieut. W. K. Harris

THE WONDERFUL HAWKESBURY BRIDGE: NEW SOUTH WALES

The Hawkesbury Bridge is one of the largest and finest examples of engineering skill in the southern hemisphere and embodies all the latest improvements in bridge designs. The most difficult part of the work in connection with the construction of the bridge was the great depth to which it was necessary to sink the piers to secure a good foundation. The body of each pier is 48 by 20 feet, with rounded ends, enlarged at the base to 52 by 24 feet, and some of the piers are sunk to a depth of no less than 162 feet below high-water mark, which is said to be the deepest bridge foundation in the world. The abutments are built of local freestone and are very fine examples of stonework. The piers from 3 feet below water are built of masonry. The superstructure of the bridge is built for a double line, and the main girders or trusses are 410 feet long between centers of end pins and 58 feet effective depth at center. The bridge is built of steel throughout, and its total length between abutments is 2,896 feet.

pledging her credit to aid them. In the Intercolonial, in the Canadian Pacific, in the Grand Trunk Pacific, and in the Canadian Northern, obligations have been assumed that might well frighten a country with 8,000,000 of people. But now, in spite of these great burdens, which conservative financiers have looked upon with great concern, she proposes to take over a new huge debt before the conclusion of this war.

Only a young people with great national spirit, with a great territorial empire and magnificent resources, prompted by the deepest loyalty to the principles of civil liberty and popular government like that of Great Britain, could boldly and calmly face a future so full of difficult problems and unparalleled financial obstacles.

Speaking of the history of Canada down to 1912, since the British North America Act, in 1867, Professor Wrong, professor of history in the University of Toronto, said:

"The history of Canada during this momentous period is not a tale of courts and camps, of the workings of diplomacy to avert or to lead to war, of the struggles between those who cherish what is

Photograph from Government Publicity Department, Sydney

WHEAT TEAMS LEAVING A FARM IN THE WESTERN DISTRICT: NEW SOUTH WALES

They do most things in Australia on a large scale, and, next to sheep raising, agriculture is the principal industry. At present there are possibly 10,000,000 acres of land under cultivation, and approximately two-thirds of it is devoted to the production of breadstuffs. The enormous wagons, on which are piled nearly a hundred great bags of grain, are drawn by teams of ten or twelve horses from the farms to the railroad, sometimes many miles away.

old and what they think is good advantage and those who dream of a new and better order. The pomp of a stately and well-ordered society, movements in art and literature, the menaces and friendships of other nations, have but little place in the narrative. The story is one of internal organization, or trade policy, of the occupation of land hitherto almost unpeopled, of the opening up of communication and the building of railways and canals, of the working of political institutions, of the disputes of the central government in its relations with the provincial powers. In one sense it is not a dramatic tale: it has little of the ceremonial of Old World movements. But, none the less, it is a profoundly romantic story of the birth of a nation and of its passing from neglected obscurity into a conspicuous place."

THE BAPTISM OF FIRE

Today Canada is passing through her baptism of fire. While there are many differences in the history of Canada and that of the United States, there are many resemblances—due, if nothing else, to the common origin of their peoples and to the material problems of settling and developing half a continent.

In our Civil War our peoples divided on an issue that developed the moral strength of the two great contending sections. Both showed themselves willing to make the ultimate sacrifice of their own lives and the lives of those dear to them and of all their material possessions. In that Civil War the people of the United States found themselves and proved to themselves and to the world their moral fiber and their greatness as a people.

Photograph from Lieut. W. K. Harris

MOUNT VICTORIA PASS: BLUE MOUNTAINS, NEW SOUTH WALES

Most Australians thoroughly appreciate their good roads, for the time is not long since when over the same route which an automobile now traverses in one short afternoon their fathers spent six weeks in hacking a way through the dense bush for their creaking bullock carts to negotiate.

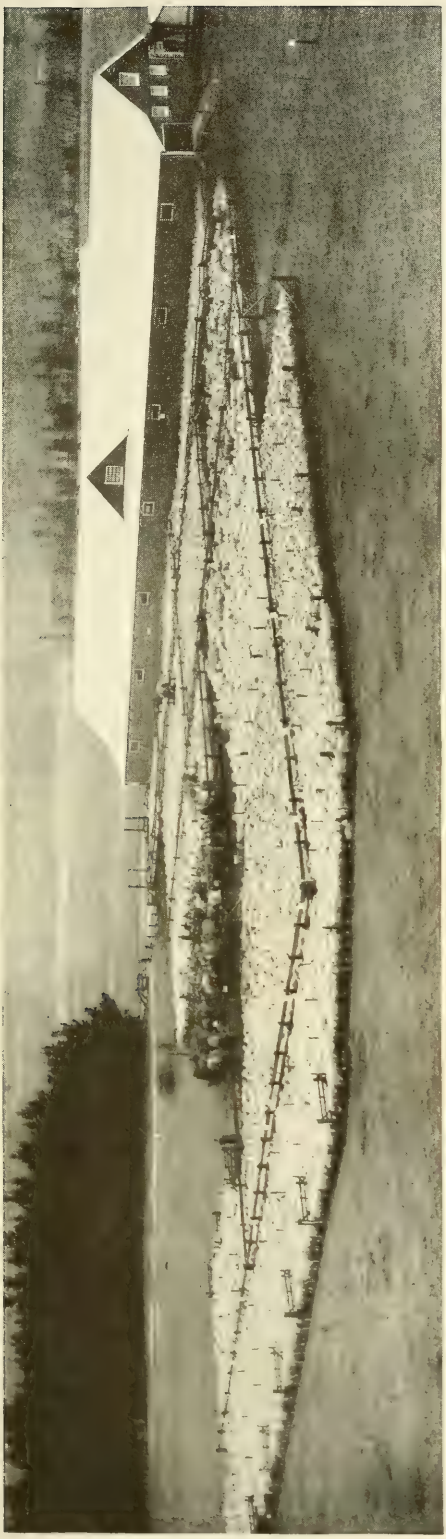
Canada is now going through a similar experience. Every family with young men of military age in the Dominion has offered, is offering, or expects to offer them up as possible sacrifices upon the altar of their allegiance to the mother country.

What is going on in Canada is also happening among Great Britain's children in Australia and South Africa. As among the French in Canada, so among the Dutch in South Africa, England's justice retains for her a loyalty that a less equitable policy would have lost.

I have not at hand the number of troops furnished by Australia and South Africa to swell the British forces, but the graves of those New England sons in the battlefields of the Gallipoli Peninsula and elsewhere bear silent but eloquent testimony to the tie that binds them to old England.

Canada is from 2,000 to 5,000 miles from the British Isles. Australia and Africa are half around the world. Their people live under different conditions. They have a different government. They must perforce, because of distance, have different views of life. The remoteness of distance and condition has much to do with destroying interest and affection and loyalty.

When it does not do so, when the patriotic thrill courses through the veins and arteries of men in Ontario, Winnipeg, Saskatchewan and British Columbia, in Australia and at the Cape of Good Hope, as hotly as in men between Lands End and John O'Groats, we would find a cause; and we do find it in the wisdom of England in dealing so generously with her trans-Atlantic, Pacific, and African daughters, and in strengthening their loyal affection by granting independence of government and assurance of protection as members of her family.



Photograph from Paul Thompson

A MODERN NEW ZEALAND SHEEP STATION

In the old days sheep raising in this Pacific archipelago meant merely turning flocks upon the public domain and letting them feed upon whatever they could find, with no other object than producing wool. Nowadays these flocks are more carefully tended and there is much attention given to their feeding. Of late years many acres of turnips and succulent English grasses have been sown to give better quality to the mutton, and the whole grazing industry has been placed upon a much more scientific and systematic basis.

ALL ARE ASSOCIATES IN A GRAND FEDERATION

The term "Empire of Great Britain" is, as applied to these governments, a misnomer. There is no imperial control in the Parliament or in the King over these peoples. They are associates of the mother country in a federation in which they enjoy complete autonomy, and the mother takes the great part of the burden of imperial defense.

Gratitude for the burden she has carried for them, a realization of the benefits their association with her as part of the so-called British Empire secures them, and the love of the liberty regulated by law, secured under the British Constitution, which is the essence of their political lives and doctrine, are the reasons for this present wonderful manifestation of loyalty.

The ultimate fact that reflects the highest credit upon the statesmanship and foresight of England is that as she has lightened her formal hold upon these New Englands, and ended their real subordination, she has strengthened their spirit of allegiance to her.

It is an eloquent tribute to the living force of a bond formed of a common inheritance of civil liberty and the principle of the rule of the people strengthened by just and generous dealings of the mother with the daughters.

The supreme test has come in the present war. It has shown that there is something besides the prospect of material benefit or of material burdens and sacrifice which controls the action of peoples.

Well may England say, as these brave, courageous legions from the Transatlantic and from the Antipodes rally to her support: "I cast my bread upon the waters, and after many days it has returned unto me."

MANY CANADIAN WOMEN HAVE VOLUNTEERED AS NURSES FOR THE EUROPEAN WAR

This picture shows H. R. H. the Duke of Connaught inspecting those who went with the University of McGill Hospital Corps

Photographs by Chesterfield & McLaren

RECRUITING IN CANADA

Two men are here seen enlisting in one of the battalions of the Canadian expeditionary forces for service in Europe

CANADIAN RECRUITING OFFICERS AT WORK ON A CITY SQUARE, SEEKING VOLUNTEERS FOR OVERSEA FORCES

Photographs by Chesterfield & McLaren

SEEN EVERY WEEK THROUGHOUT THE DOMINION OF CANADA: TROOPS LEAVING INLAND POINTS TO EMBARK FOR THE EUROPEAN WAR

H. R. H. THE DUKE OF CONNAUGHT INSPECTING THE 42D BATTALION OF HIGHLANDERS AS THEY MARCHED OFF TO THE SHIP THAT CARRIED THEM TO EUROPE

A sight to be seen at regular intervals in Canada

Photographs by Chesterfield & McLaren

QUAINTNESS IN RELIGION OF QUEBEC PROVINCE

A view which gives some idea of the huge numbers that will gather at an open-air mass

Photograph by Chesterfield & McLaren

A RECRUITING PARADE OF WOMEN AND CHILDREN WHOSE HUSBANDS AND FATHERS HAVE GONE TO THE FRONT, WITH THE OBJECT OF STIRRING UP MILITARY ENTHUSIASM

Photograph by Chesterfield & McLaren

THE OLD AND THE NEW AT THE ANCIENT CAPITAL

Troops in training for the present great war are here seen passing through the St. Louis Gate of the fortifications of Quebec City, which were built by British regulars after the conquest of 1759

FREIGHT STEAMSHIPS LOADING IN MONTREAL HARBOR

Photographs by Chesterfield & McLaren

FORT WILLIAM, ONTARIO, HAS THE LARGEST GRAIN ELEVATOR IN THE WORLD

Built by the Grand Trunk Pacific, Canada's newest transcontinental line, to facilitate transfer of western grain from rail to inland boat. Its capacity is 7,500,000 bushels, and it was planned so that its storage space can be trebled as the grain trade expands.

QUEBEC PROVINCE: A CHURCH CEREMONY AT ST. PATRICK'S, THE LEADING IRISH CATHOLIC CHURCH OF MONTREAL

Prominent business men act a guard of honor in the procession through the grounds of the church

Photographs by Chesterfield & McLaren

WINTER FESTIVITIES IN CANADA

Street parade of snowshoe clubs on the occasion of a snowshoers' convention

Photograph by Chesterfield & McLaren

CANADA'S RUINED HOUSES OF PARLIAMENT

The Federal Parliament building at Ottawa was completely gutted by fire on March 1. It was said to have been the finest specimen of Gothic architecture in America, and is to be reconstructed as per original plans.

Photograph by Chesterfield & McLaren

WAR CANOE RACING, THE POPULAR AQUATIC SPORT

Every waterside town in Canada has its canoe club, and all members look forward to the annual races, which terminate in the Canadian Canoe Championship races at the end of the season. This picture shows the finish of one of the big races.

Photograph by Chesterfield & McLaren

"BOUNCING" IN CANADA

Winter climate is made the most of and all Canadians take an interest in outdoor sports. The picture shows a crowd of merry snowshoers "bouncing" one of their comrades when meeting him in the streets.

THE WORLD'S STRANGEST CAPITAL

By John Claude White

Author of "Castles in the Air," in the National Geographic Magazine, April, 1914

LHASA, the Place of the Gods, well deserves its name, as anything more beautiful can hardly be imagined than the vision of the sacred city set against its magnificent background of snow-capped mountains. Whether seen on a brilliant day, under a cloudless sky, during a thunder-storm, painted in soft, glowing tints by one of the wonderful sunsets seen only in Tibet, or by moonlight, when with outlines softened and toned down, the Potala stands out like a phantom castle in ghostly splendor from among the shadows of its surrounding trees, all aspects are equally lovely.

My readers are referred to the panorama of Lhasa, published as a supplement to this number of the Geographic Magazine.

The Potala is by far the finest building and eclipses all others in the beauty of its appearance. The present Potala was commenced in 1645 by the Grand Lama Nag-wang Lob-sang-gya-tsho, on the same site as a former building erected by Srong-tsan-gam-po, the king who founded the Jo-kang in the sixth century; and there is no doubt, I think, that the city is an ancient one and was in existence more than 1,200 years ago, although we can find no records giving any authentic historical account.

A DOMINATING STRUCTURE

The Potala dominates everything in Lhasa. The enormous mass of buildings, partly monastery, partly palace, and partly fortress, is built on a rocky ridge which stands out in the center of the valley, commanding the town and dominating the whole situation. Its architecture is magnificently grand, bold in outline and design; it towers above everything, with its gray white walls and buttresses, its immense flights of steps and terraces dotted with red-robed monks ascending and descending from religious ceremonies; its dull madder-red temple walls, with carved and painted windows, showing behind black brown yak's hair hangings, surmounted by its gilded roofs and set in almost park-like surroundings of trees and meadows, with snow-capped mountains on all sides and the Kyi-chhu, the River of Delight, running clear in many channels through groves of willow or poplar.

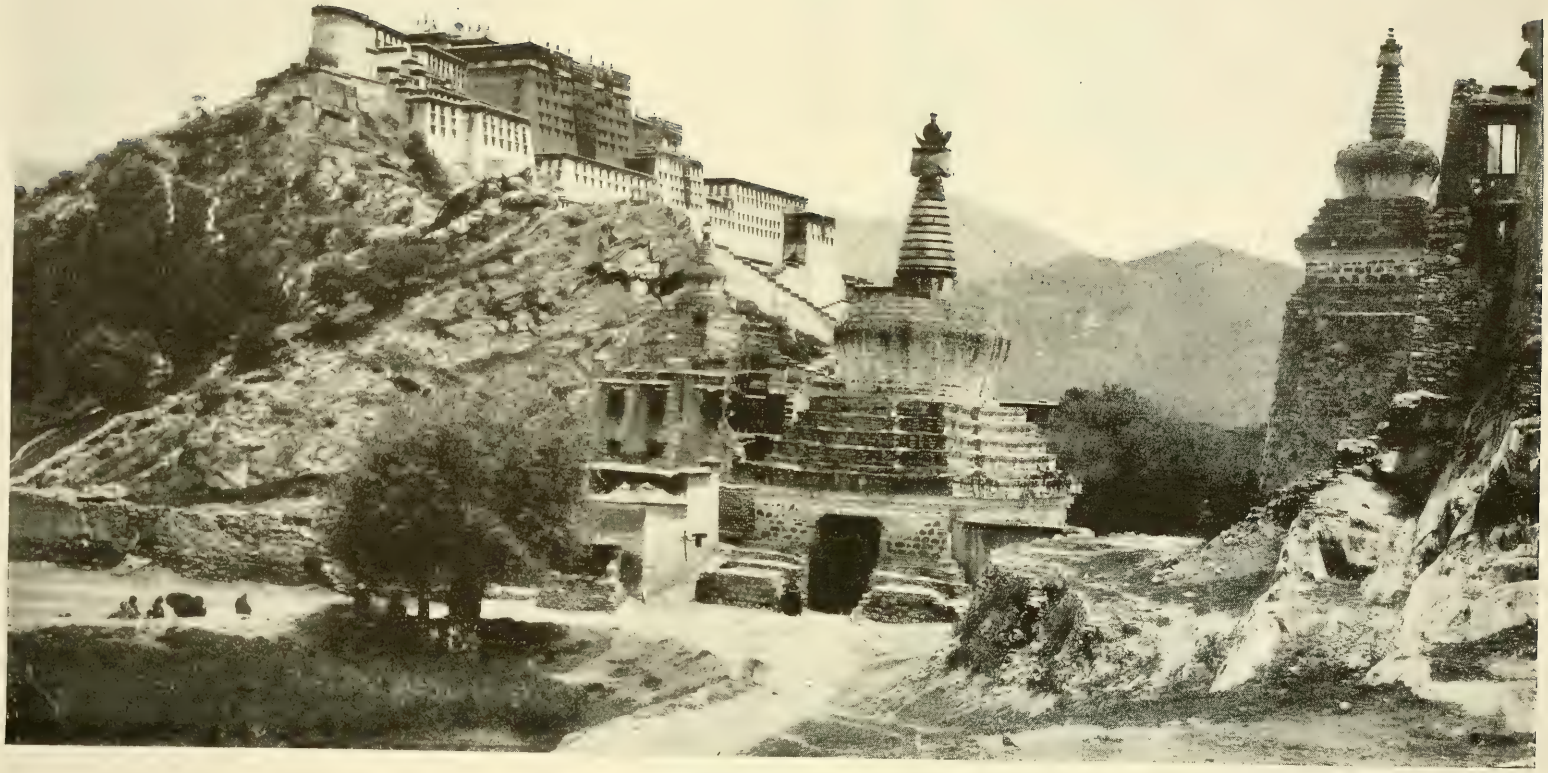
It is indeed a fitting shrine for the heart of any religion, and with such surroundings it is difficult to understand how the present form of Buddhism (Lamaism), as practiced in Tibet, could ever have sunk to the depths of degradation it has reached. It is devoutly to be hoped that some reformer may arise to cleanse it of its many superstitions and to reinstate the simple tenets of its founder.

A DISAPPOINTING INTERIOR

But the interior of the Potala is curiously disappointing, as it consists principally of a mass of dark passages and cells, a certain number of halls and flights of steps.

Among the larger halls were several striking ones, especially that in which was the gilt tomb of Nag-wang-Lob-sang Gya-tsho; the dome of this hall extended upward through several stories. On the tomb there was a great deal of metal ornamentation and the whole formed a fine piece of work. On each side of the principal tomb were similar ones of smaller dimensions, those of Dalai Lamas less notable.

In another room of fairly large dimensions the walls were lined with shelves from floor to ceiling, each shelf closely packed to its uttermost extent with images of Buddha. There must have been thousands of all metals—gold, silver, copper, brass—and many were of very beautiful workmanship. In another chapel there were hundreds of golden butter lamps.



THE GATEWAY TO LHASA

Photograph by John Claude White

The entrance or doorway into Lhasa passes through the *chorten*, or shrine, in the center of the picture, which is locally known as the Pargo Kaling. Remark the strings of bells hung on either side of the *chorten*. The darker portions of the Potala are the temple buildings and are colored madder-red, with the golden roofs appearing above.

It would be quite impossible to give even a semblance of a plan of this conglomeration of buildings, and it would take weeks, perhaps months, to visit every part of the enormous structure, capable of holding thousands of people. The Treasure House was said to be full of gold and jewels at the time of our stay; but we had no opportunity of inspecting it, nor did we see the Dalai Lama's private apartments, in the northeast corner of the building, as we were particularly asked by the Tibetans not to enter this part of the building and of course did not do so.

IMPOSING LANDSCAPES

From the flat roofs of the Potala the whole valley lies mapped out below—the town to the east, a mass of low, two-storied, substantially built houses interspersed with temples; the Jo-Khang, the most holy shrine in Tibet; the Chagpo-ri, or school of medicine; the Turquoise Bridge (Yutok Sampa), so called on account of its green-blue tiled roof; the many channels of the River of Delight (the Kyi-chhu), beyond which lies the Arsenal, and to the north the Monastery of Sera under the hills, containing 5,000 monks (see page 281). Further on the Debung Monastery, with 10,700 inmates; the gilded roofs of the Na-chung-chos-kyong (see page 286); and the Ling-Kor, the Sacred Road (see page 288), along which all devout Buddhists prostrate themselves in the hope that all their earthly sins may be forgiven, could be seen in places.

PICTURESQUE PRIESTS

There are monks everywhere in or near Lhasa. The three large monasteries of Sera, Debung, and Gah-dan alone contain about 20,000, and with all the other temples and monasteries the number cannot fall far short of 30,000, while the lay population of Lhasa only amounts to about 15,000, of whom 9,000 are women, who, strange to say, carry on practically the whole of the trade done. The remaining 6,000 males are about 3,000 Tibetans and 3,000 foreigners—Chinese, Nepalese, Kashmeris, etc.

The monks are very picturesque in their somber red robes, perhaps not quite so much in evidence in the town itself, as there there is more bustle and life and people are more occupied with trade than with the saving of their souls. The streets are full of laden animals, bringing in the every-day supplies, and caravans arriving from Mongolia and eastern Tibet. The people look well and cheerful and the town is not nearly so dirty as might be expected.

Of the other buildings in Lhasa, the School of Medicine, situated on a smaller hill on the same ridge as the Potala, stands out prominently. There is very little of interest connected with it, and the inmates or students hardly knew even the names of common useful herbs.

One of the prettiest spots in all the valleys was the Lu-Kang Garden, where there is a beautiful pool of water surrounded by lofty trees and willows half concealing an island in the center.

The legend runs that the island is the abode of a snake, which must be propitiated or the waters of the underground lake which lie beneath the Jo-Khang will overflow and submerge Lhasa. Doubtless the legend is founded on the fact that water lies close under the city and no well need be sunk more than 6 feet to reach the water level. When I visited the gardens the clear, brown water was extremely peaceful and reflected with added effect the beautiful coloring of its surroundings.

The quarter of the beggars, scavengers, and outcasts showed in what extraordinary hovels these people can and do live. Many of the walls of the huts were built of yaks' horns set in mud, and I need hardly say were most insanitary.

THE TURQUOISE BRIDGE OF LHASA

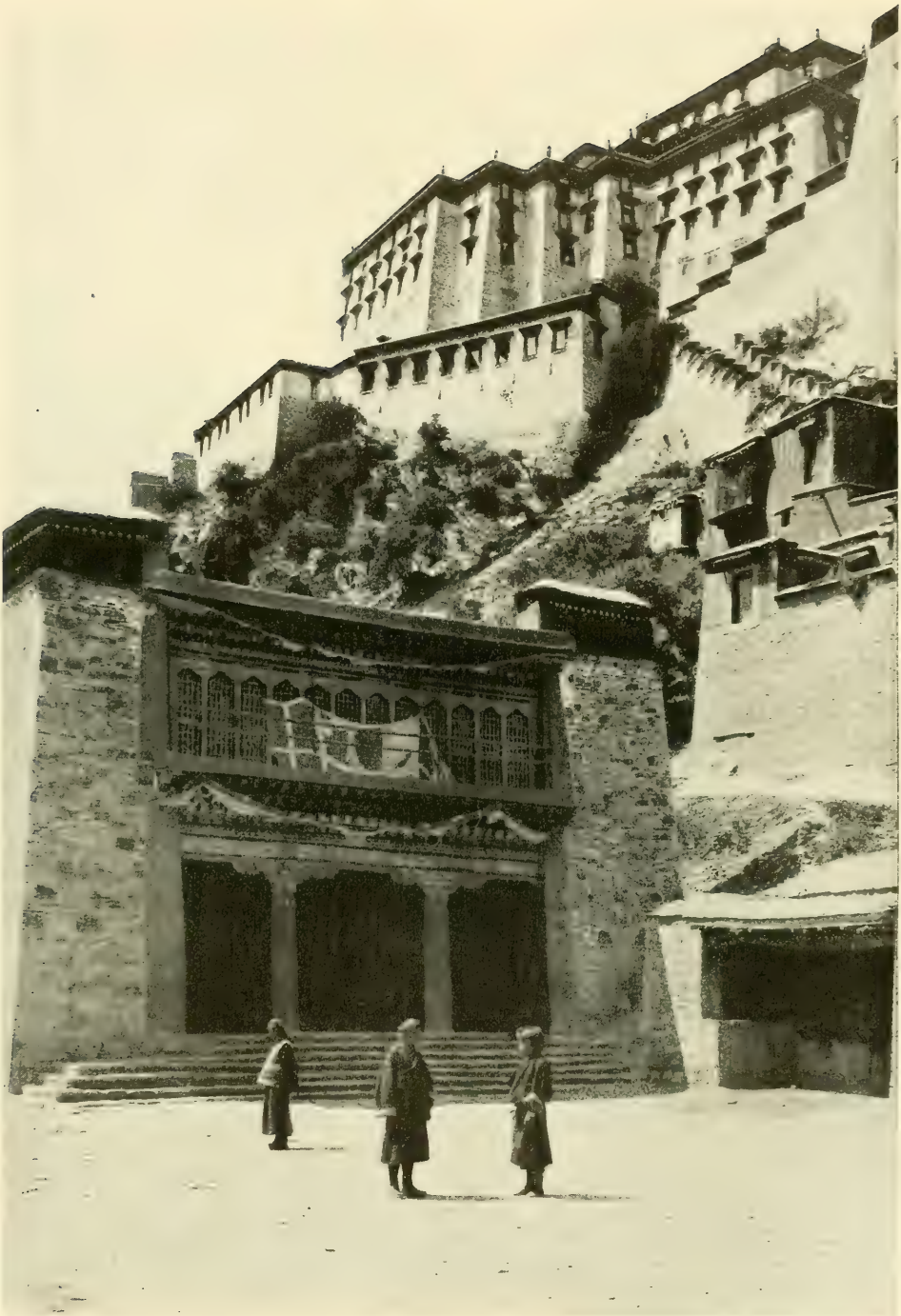
Not far from the Cathedral is one of the sights of Lhasa, the Turquoise Bridge, so called on account of the lovely coloring of the green blue tiles of the roof. Encircling the buildings is the Sacred Road, merely to walk along which absolves the mortal from all earthly sins, and many pilgrims prostrate themselves for its entire length, thus securing everlasting happiness in their future life.

The most interesting portion of the Sacred Road is where it nears the Kyi-chhu and runs through some sharp lime-

Photograph by John Claude White

VIEW TAKEN FROM ONE OF THE COURTYARDS OF THE OFFICES ATTACHED TO THE POTALA

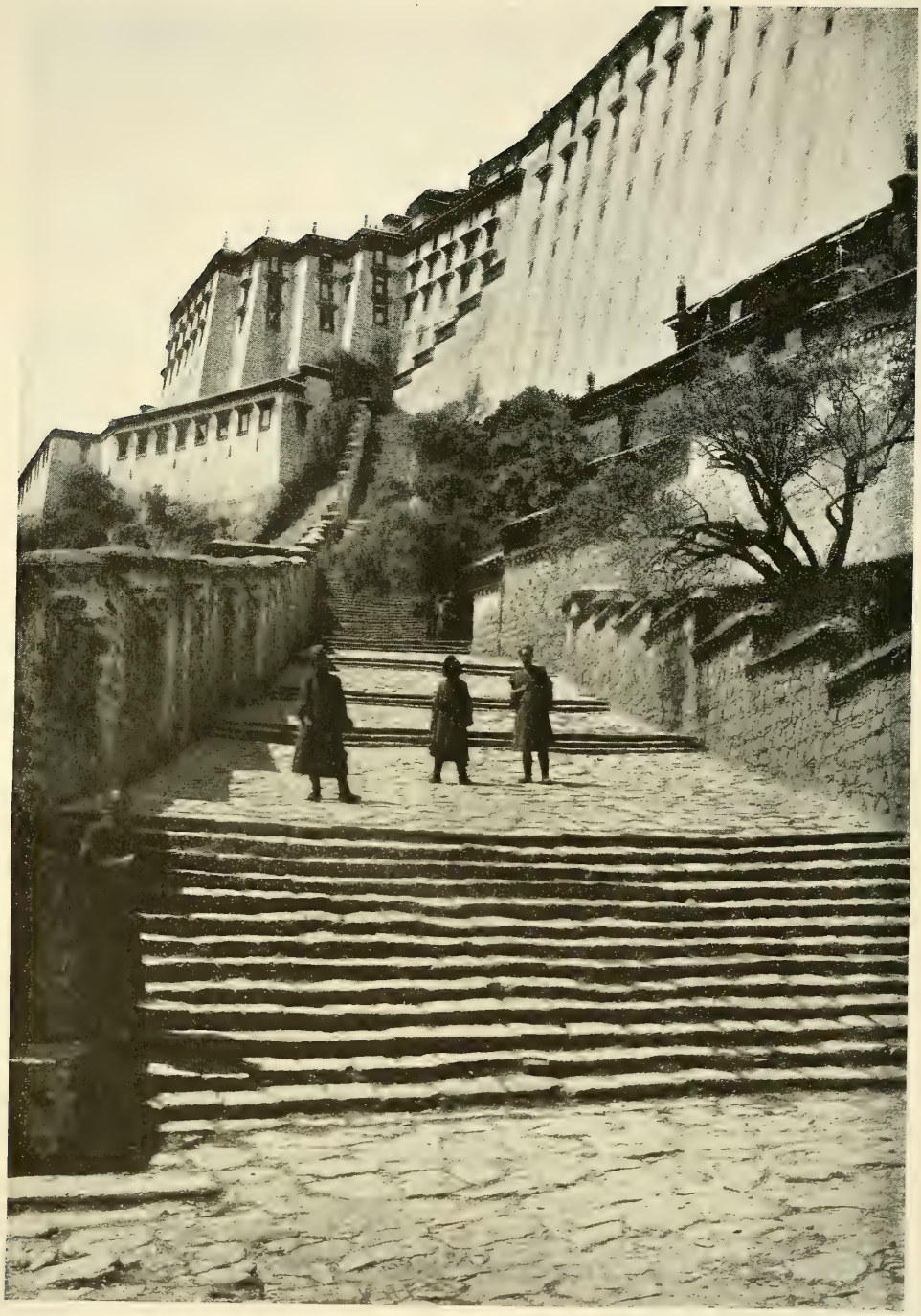
"It is indeed a fitting shrine for the heart of any religion, and with such surroundings it is difficult to understand how Lamaism could have sunk to the depths of degradation it has reached" (see text, page 273).



Photograph by John Claude White

THIS VIEW GIVES SOME IDEA OF THE HEIGHT OF THE POTALA. THE DOORS IN THE CENTER ARE THE ENTRANCE TO SOME OF THE OFFICES.

"The Potala dominates everything in Lhasa. The enormous mass of buildings, partly monastery, partly palace, and partly fortress, is built on a rocky ridge which stands out in the center of the valley, commanding the town and dominating the whole situation. Its architecture is magnificently grand, bold in outline and design; it towers above everything, with its gray white walls and buttresses, its immense flights of steps and terraces dotted with red-robed monks ascending and descending from religious ceremonies" (see text, page 273).



Photograph by John Claude White

A FLIGHT OF STEPS ON THE SOUTHWEST SIDE OF THE POTALA

This structure "is set in almost park-like surroundings of trees and meadows with snow-capped mountains on every side, and the Kyi-chhu, the River of Delight, running clear in many channels through groves of willow or poplar" (see text, page 273).

Photograph by John Claude White

AT THE TOP OF THE MAIN FLIGHT OF STEPS, SHOWING THE TERRACE LEADING TO THE MAIN ENTRANCE

This picture also shows the yak's-hair curtains hung to protect the painted carving on the entrance

Photograph by John Claude White

PRAYER FLAGS STRETCHED ACROSS AN ARM OF THE KYI-CHHU TO AN ISLAND

"All devotees, men and women, walk, always turning a small hand prayer-wheel, filled with minute prayers, printed on thin paper; and larger prayer-wheels, filled in some cases with tons of paper prayers, are set revolving by the devout, or are sometimes worked by water-power. Smaller ones are turned by the hot air rising from butter lamps" (see text, page 271).

stone rocks, carved deeply with figures of Buddha cut into the rock and painted in many colors (see pages 280 and 288).

From the rocks prayer flags are suspended on lines running to an island in the river. These prayers are universal in Tibet, and so long as they are moving they are recording prayers for the benefit of those who put them up. All devotees, men and women, walk, always turning a small hand prayer-wheel, filled with minute prayers, printed on thin paper; and larger prayer-wheels, filled in some cases with tons of paper prayers, are set revolving by the devout, or are sometimes worked by water-power. Smaller ones are turned by the hot air rising from butter lamps.

THE FAITH OF THE LAMA

Single prayers, printed on thin cloth, are strung vertically on poles or stretched across open spaces to flutter in the wind and thus send millions of prayers vibrating toward the Omnipotent for the benefit of some one's soul. They are most picturesque. An old Lama I once questioned on the subject told me "that if the person turning the wheel truly believed that by doing so he was accumulating merit, it would certainly count as a meritorious action."

The three great monasteries round Lhasa, Debung, Sera, and Gah-dan, known as the Sen-de-gye-sum, exercise very considerable power.

I was asked to visit two of these monasteries—Sera and Debung—by special invitation of the Lamas, a very great honor, which I thoroughly appreciated, and I felt highly flattered to find myself known to these Tibetan monks as a result of my intercourse with their coreligionists during the years I had spent in Sikhim.

Debung, with its huge Lama population, is like a small town, with streets, alleys, and temples. The streets are steep and paved with granite blocks and the alleys are narrow and dark, and were filled with crowds of monks surging up to see the foreigner. My attendant Abbot, accompanied by lictors with large, heavy whips and under-Lamas carrying iron maces with heavily embossed copper plates ornamenting the sides, had considerable difficulty in keeping order, and the lash of the whips resounded as they laid on with no light hand to those who did not obey orders.

The Head Abbot and Lamas were in every way superior to the vast crowd of lesser monks, many of whom were of a very low type and standard generally, and they looked a villainous and truculent lot, who, I fancy, require a rule of iron to keep them in any kind of order.

I was entertained at each of the four sections of the monastery with a repast of tea, dried fruits, sweets, and murwa (a kind of beer), and I was shown several of the Lamas' cells, which, though small, were quite clean and tidy, and had each a window. The monastery has a bad reputation for lawlessness and in it all manner of plots are hatched and much wickedness goes on.

By far the most charming of the monasteries near Lhasa is that of the Chief Oracle and Magician, the Ne-chung-chos-Kyong. It lies in a small valley near Debung, with a good supply of water, and is consequently surrounded by beautiful groves of trees and lovely gardens with streams running through them. Coming upon it in the midst of a sandy plain enhances the charm of this delightful spot, and the relief it is to leave the glare and dust for its cool, shady walks.

A TOUCH OF ITALY IN TIBET

The entrance takes one through a street with houses on either side, Italian in coloring and style, and then up many steps to the principal gate. Passing through the gateway, the green luxuriance of leafy trees is in striking contrast against the whitewashed walls of the houses and the madder red of the temple itself, with the brilliant coloring of its doorways and pillars and the gold of the fantastically shaped roofs glittering in the blazing sunshine against a clear blue sky, with lines of prayer flags fluttering in every direction.

Turning up a flight of steps, the main temple is reached, passing on the way through a cloistered courtyard and a corridor supported by carved and decorated pillars, hung with ancient arms, leading

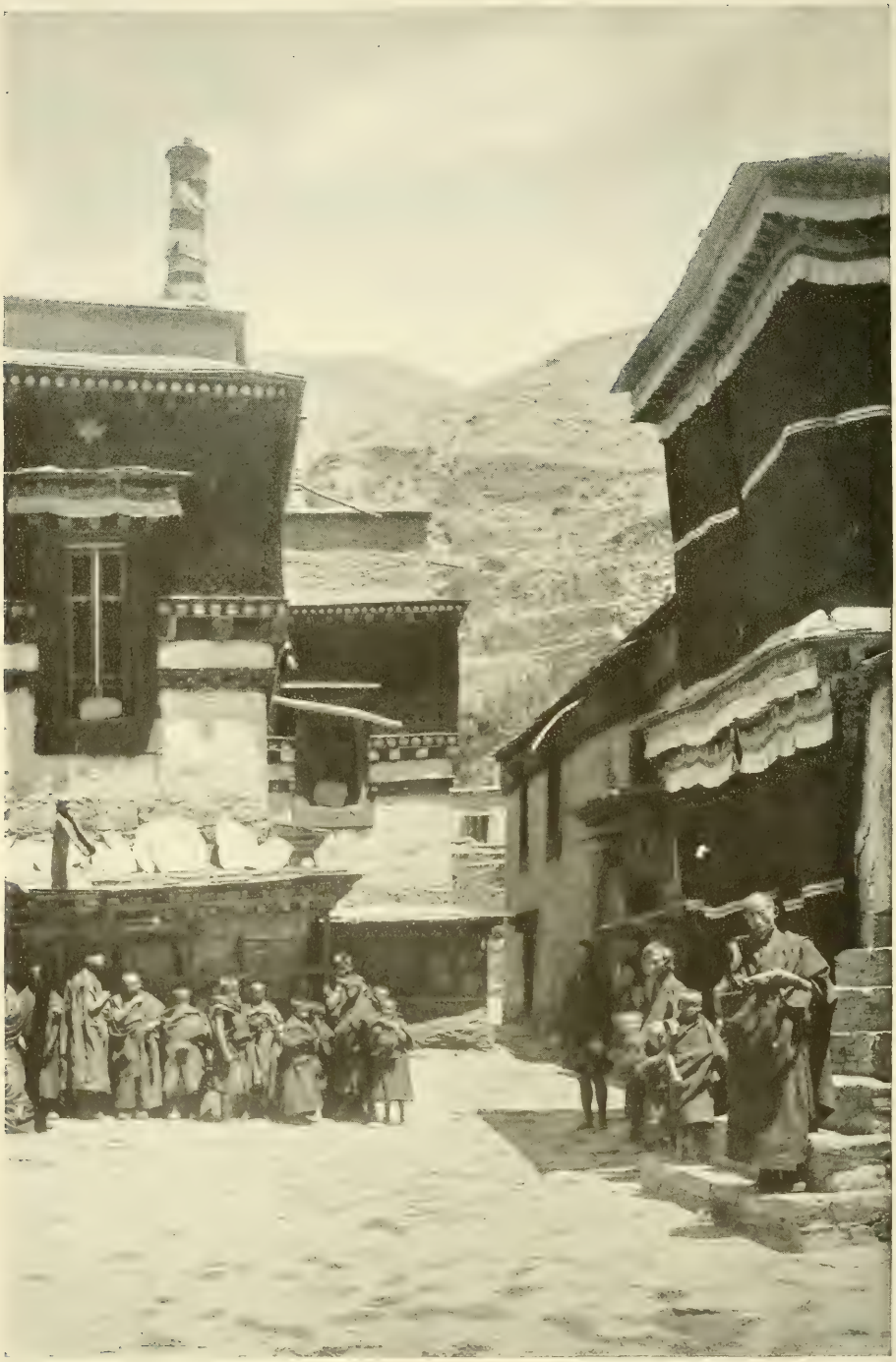
Photograph by John Claude White

A FINE ROW OF CHORTENS ON EACH SIDE OF THE ENTRANCE TO LHA-LUNG MONASTERY: TIBET

Animal life was not very plentiful, but there were fairly large flocks of burhel (*Ovis nahura*) and a good many nyen (*Ovis ammon*) on the higher hills, and in the eastern districts I came across hundreds of the latter, as tame as ordinary sheep. On the plains Tibetan gazelle and wild asses were occasionally to be seen, but not in great numbers. The wild ass is a graceful creature of a red-brown color, with black markings and points, and very inquisitive. A herd would circle round for hours, keeping well out of range, but offering splendid opportunities for observation. There was an occasional wolf or red fox to be met with and a few Tibetan lynx. Hares abounded and large colonies of both the small and greater marmot, and in some places at the foot of the hills a good bag of partridge could be had. These, with a few Tibetan sand grouse, made up the total, though in the autumn the lakes were crowded with duck and geese. The wild birds were interesting, and there was one species which built its nest in the same burrow as the small marmot, with whom they lived on very friendly terms.

Photograph by John Claude White

COURT OF THE LHA-LUNG MONASTERY, WITH THE AVATAR, OR INCARNATE LAMA, ON THE BALCONY



Photograph by John Claude White

INTERIOR OF THE LHA-LUNG MONASTERY, WITH GROUPS OF LAMAS

The number of monks in Tibet is said to be very large, nearly 500,000 housed in 1,026 monasteries, and this out of a population of about three and one-half millions is a very large proportion and affects very adversely the country's material progress.

up to the principal doorway. Behind great hangings of black yak's hair, to screen them from the sun, are the magnificently carved doors, brilliantly colored in carmine and vermilion.

Peace reigns, the courtyard is full of flowers, and everything is quiet and orderly, conducive to the meditation which forms so large a part of the Buddhist religion.

Entering the great temple itself through the wonderful doors and passing through it, the Inner Sanctuary was reached. In it was the Golden Throne of the Chief Oracle, and on it lay his Robes of State, Sword of Office and Shield, and on all sides were the jeweled paraphernalia required for ceremonial processions and dances, so essential to Lamaism. It was evident great care had been bestowed on them, and they were specimens of beautiful workmanship and adorned with many really fine turquoise. One in particular, a circular "Mirror of Purity" of polished silver, set in copper gilt repoussé work, ornamented with turquoise, was exceptionally good.

THE MAGICIAN'S PRIVATE DWELLING

Leaving the temple and courtyard, we ascended to other temples, all elaborately decorated and beautifully kept, and then went out on the roof immediately below the Golden Roof for a nearer inspection of it and its exquisitely designed dragon-head finials. We next visited the magician's private dwelling-house, situated at the back of the main temple in a beautiful miniature garden, in which bamboos, hollyhocks, nasturtiums, stocks, and roses were all growing luxuriantly, watered by a tiny stream of clear water.

The windows were protected by delightful white awnings, and inside everything was scrupulously clean, the floors and woodwork so highly polished one felt one should do as in Japan and remove one's boots, and the walls charmingly decorated with fresco painting.

The religion inculcated by Buddha had certain cardinal points—the encouragement of the ascetic life, the maintenance of virtue, the exhortation to persons of all castes and both sexes to aim at deliverance from the evils of existence, and lastly the attainment of Nirvana.

But in Tibet Buddhism has been grafted onto the earlier devil worship of the people and a religion has been evolved better expressed as Lamaism, or modified devil worship, so that in addition to the Buddhas and Bodisats there have also come to be Tutelary and Guardian deities of a terrifying and malignant aspect, whose duty it is to defend the faith and the faithful people from external attack. These deities are depicted in grotesque and terrible forms in all the monasteries, generally in violently colored fresco paintings at the entrance.

CREDULOUS PEASANTS

The credulous peasants, steeped in superstition, look up to and pray to these monstrosities for their deliverance from evil, from the lures and persecutions of the demons and sprites, by which every Tibetan regards himself as surrounded.

The common folk believe, too, in mischievous and malignant gods, some in the shape of gnomes, some hobgoblins, others with such long slender necks and small mouths they can swallow nothing, and in their attempts writhe to such an extent their struggles cause earthquakes Another belief is that rainbows are formed by innumerable sprites, or small folk, sliding down into water, sprites who live only on smells and twang guitars as they slide; and that drinking the water will give fever. Others living on the tops of hills or passes send down avalanches and give travelers mountain sickness, and perhaps the most dreaded of all are the "shri," who attack children.

All these beliefs are more or less the religion of the common people, combined with the hope of being perhaps reincarnated into a higher sphere and of ultimately being admitted into Nirvana.

CHARMS COULD NOT STOP NICKEL BULLETS

Tibetans have absolute faith in charms protecting them from all dangers and evils, and once during our stay when a prisoner was being treated for wounds and was asked how he, having the requisite charms from the Lamas, could have been wounded, answered that he had no charm against a nickel bullet, such metal being unknown to the Lamas.

They are strictly forbidden to take life.

Photograph by John Claude White

A COURTYARD IN THE NACHUNG MONASTERY, WITH LARGE NUMBERS OF PRAYER FLAGS HUNG ACROSS THE COURT: THE UPPER PART OF THE TEMPLE IS COLORED MADDER-RED

It lies in a small valley near Lhasa, with a good supply of water, and is consequently surrounded by beautiful groves of trees and lovely gardens with streams running through them. Coming upon it in the midst of a sandy plain enhances the charm of this delightful spot, and the relief it is to leave the glare and dust for its cool, shady walks.

Photograph by John Claude White

THE CHIEF ORACLE'S PRIVATE APARTMENTS IN THE NACHUNG MONASTERY

The windows are shaded by picturesque white awnings and the garden is full of flowers. The golden roofs are very fine. Around them hang numerous bells, which ring with every movement of the wind.

Photograph by John Claude White

CARVINGS ON THE LIMESTONE ROCKS ON THE LING-KOR ROAD: LHASA

These are all brilliantly colored and nearly all representations of Buddha (see page 275)

The Tibetan believes that any failure on his part to acquire merit in this world will not result in immediate punishment, but in a never-ending repetition or reincarnation in some form or other of life in this world, when his struggles will commence over again.

Their religion teaches men to attend only to their own salvation; it teaches nothing of any duty to the State or to the well-being of the community and leads to the deterioration of the nation as a whole.

It is the usual custom for the eldest son of the family to enter a monastery, and sometimes more than one son takes to the religious life. In addition to being considered an honorable profession, it is an exceedingly lazy life and appeals to many. They are required to do nothing, while they are clothed, housed, and fed at the expense of the State.

Many of the monasteries are supposed to have schools, but they are of no use and teach nothing of any practical value. All kinds and conditions of men are admitted and the result is not satisfactory, as the bulk of those I saw in the large monasteries were a degraded and in many cases a bestial lot.

ONE-SEVENTH OF THE PEOPLE ARE MONKS

The number of monks in Tibet is said to be very large, nearly 500,000 housed in 1,026 monasteries, and this out of a population of about three and one-half millions is a very large proportion and affects very adversely the country's material progress.

The Tashi and Dalai Lamas never die,

Photograph by John Claude White

A PORTRAIT OF THE TASHI LAMA WITH HIS MINISTERS AND FOLLOWERS

as their souls on departing the life are reincarnated in the body of some infant, who by some miraculous sign, such as the recognition of a rosary, an article of clothing belonging to the deceased, or something of that sort, establishes his claim.

Mr. Wilton tells us how the Chinese manipulate the selection to insure the chosen candidate belonging to the pro-Chinese faction. When the choice has been narrowed down to four, four fish-shaped tablets are publicly placed in a golden urn, the gift of the Great Manchu Emperor Kienlung. The name inscribed on the first tablet drawn is hailed as the Dalai Lama, and it is the custom to solemnly recommend him for confirmation to the Chinese Emperor by the Amban.

Kienlung's method of choice of a Dalai Lama was intended to prevent a selection likely to be detrimental to Chinese interests, and this is how it was carried out: The selection of the infant was left entirely in the hands of the Tibetans; only the final putting in of the four fish tablets was superintended by the Tibetan Regent and the Chinese Amban. The actual drawing was done by a Tibetan; but to insure the right candidate, all four tablets were inscribed with the same name.

The last four Lamas—ninth, tenth, eleventh, and twelfth—have all died before attaining their majority, 18 being the age of majority for a Dalai Lama. It was prophesied in Lhasa ten years before the present incumbent's selection, in 1876, that he would be the last of the Dalai Lamas, and, as events have turned out in China during the last few years, it is more than likely we shall not see another.

Photograph by John Claude White

A VERY GOOD EXAMPLE OF THE CANTILEVER PRINCIPLE AS APPLIED IN THIS PART OF THE WORLD (TIBET)

The hills in the background are those crossed by the Jeylap-la and Natu-la passes. Both of these passes are over 14,500 feet and very difficult, especially in winter, when they are often blocked for days together by deep snow.

Photograph by John Claude White

SOME OF THE NUNS OF THE TA-TSHANG NUNNERY

Their head-covering is made of sheep's wool. Carved on the stones is the sacred formula, "Om-mani-pade-hum" (Oh, the Jewel in the Lotus). Not very far from Khamba Jong was the nunnery of Ta-tshang, situated in a most dreary spot, with not a single habitation in sight; and in winter it must be a terrible place, wind-swept in all directions except the north. The nuns, however, seemed quite happy and contented, though they are the dirtiest lot of women I have ever seen, and after visiting the interior of the building and seeing the refectory we were thankful to be in the open air again.

Photograph by John Claude White

A FINE SPECIMEN OF A TIBETAN FORT: TUWA JONG AND MONASTERY

The trees here are willows. The power of the sun is so great in this clear atmosphere that at the present day, at the height of 15,780 feet, barley ripens in irrigated fields along the southern slopes of the limestone hills on which the fort is built, and in a sheltered corner below the jong there are very old willow trees with gnarled and twisted trunks; a few miles away, in some sandy hills, there is quite a forest of juniper with trunks, though stunted, running to 18 inches in diameter. Another marked and common feature in some of these elevated wind-swept plains are the bright yellow sand-hills, which are almost all crescent-shaped and at right angles to the prevailing wind, many of them rising 80 or 100 feet in height in the center.

Photograph by John Claude White

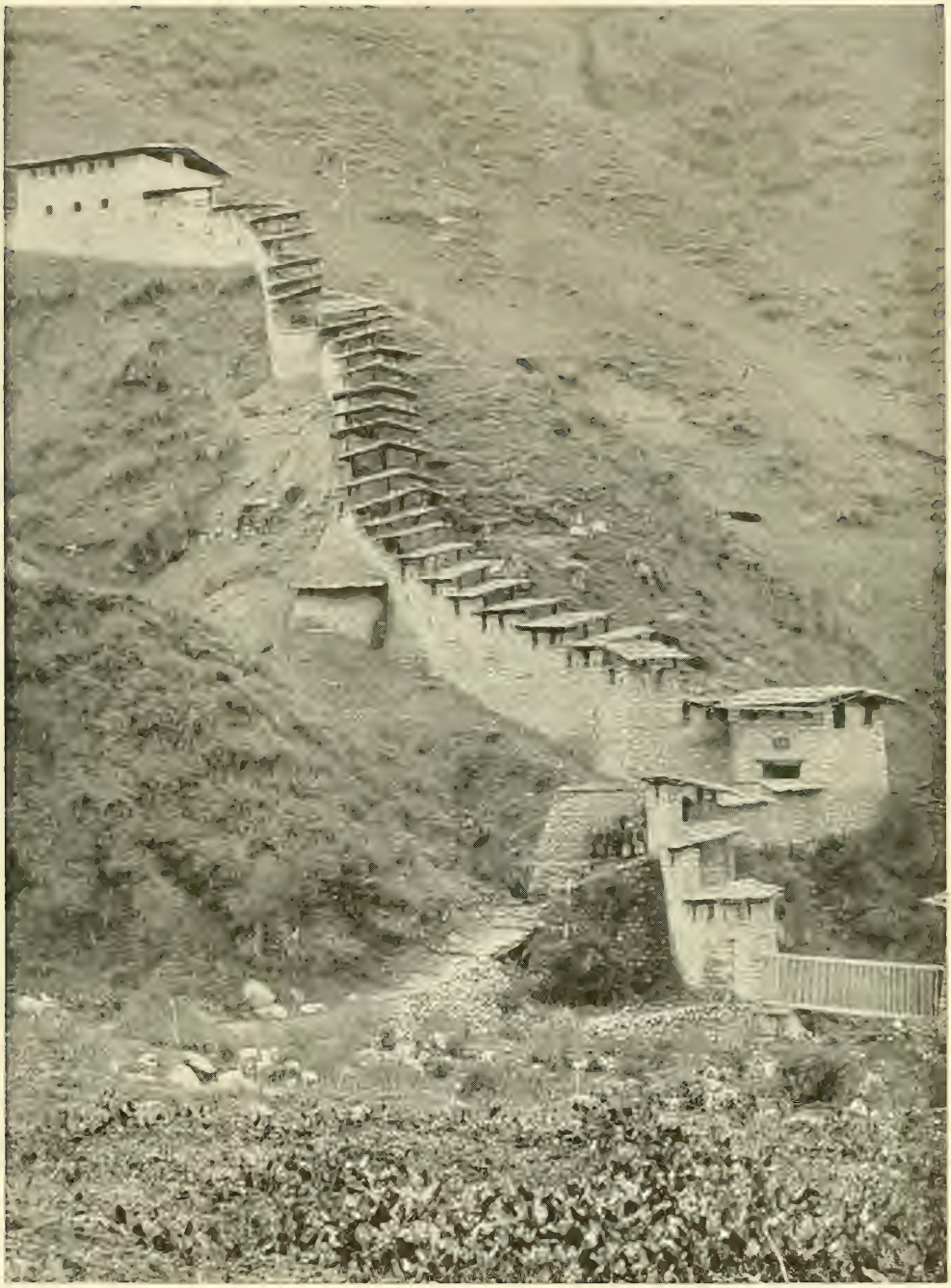
THE SHIGATSE ABBOT IN HIS TENT AT KHAMBA JONG

This Tibetan Abbot is the third man in importance in Tibet. He came to the camp with his secretary, who is seen seated with him. Our camp was unusual—unique, I think I may say—lying, as it did, at an elevation of 15,870 feet, higher than Mont Blanc, in an almost level plain, with a magnificent panorama of the Himalayas stretched out before us to the south; Kinchenjunga, 28,150 feet, and Mount Everest, 29,002 feet, the highest mountains in the world, distinctly visible, while behind us rose sharply the picturesque building of Khamba Jong, built on an overhanging limestone cliff.

Photograph by John Claude White

VIEW OF THE FORT OF KHAMBA JONG, BUILT ON A PRECIPITOUS LIMESTONE CLIFF AT AN ELEVATION OF NEARLY 16,000 FEET, IN TIBET, 20 MILES FROM THE INDIAN FRONTIER

The origin of the jongs, or forts, which are dotted all about this part of Tibet, is very obscure, and I could get no history of this one. The Jong-pen, or governor, evidently knew nothing, nor could he produce any old documents which could throw any light on the subject. My observations led me to believe that in the not very distant past these regions received a much larger rainfall than they do at present. With this heavier rainfall, there was better grazing and consequently a far larger population, and this is proved by the very large number of deserted villages and houses to be seen in all directions, as well as by the old water channels for carrying water to cultivated areas. There are thousands of houses in these valleys now standing empty. These forts were a necessity in more prosperious times, when the population was comparatively great, and were required for protection against raids as well as for administrative purposes.



Photograph by John Claude White

THE WALL ACROSS THE ROAD AT YATUNG, IN TIBET

We found some remarkable hot springs not far from here, the water in some cases registering boiling point. Many Tibetans congregate round these springs to bathe, and the water, which is highly charged with sulphur, is considered specially efficacious in cases of skin disease. Bathing is a simple proceeding on their part. All that is considered necessary is to scoop out a depression in the deposit round any spring, and this, filled with water, makes the bath. A tent is sometimes thrown over it, and the whole family—men, women, and children—sit for hours in the steaming water, and they certainly look a different color after a prolonged immersion, the process removing several layers of dirt.

VOICE VOYAGES BY THE NATIONAL GEOGRAPHIC SOCIETY

A Tribute to the Geographical Achievements of the Telephone

PERHAPS never before in the history of civilization has there been such an impressive illustration of the development and power of human mind over mundane matter as was demonstrated at the annual dinner of the National Geographic Society, at the New Willard Hotel, in Washington, on the evening of March 7, the fortieth anniversary of the award of the patent for the invention of the telephone to Alexander Graham Bell.

The occasion was in itself inspiring. Science, art, diplomacy, statecraft, and business had sent their most distinguished representatives to join with the Society in honoring those whose services to civilization had been so far-reaching and which were to be so dramatically demonstrated during the evening. From the four corners of the country had come a nation's elite to join with the Society in crowning with the laurels of their affection and admiration the brilliant men whose achievements had made possible the miracles of science that were to be witnessed.

And if the occasion was impressive and its setting inspiring, the events of the evening were dramatic beyond measure, for it seemed indeed that at last fact had outrun fancy, and that imagination had acknowledged the supremacy of actuality.

LATTER-DAY MIRACLES

Small wonder was it that at the evening's close the men who help guide the destinies of the nation had in subdued emotion declared that they felt "humbled and meek and overwhelmed!" What wonder that they in amazement exclaimed to one another, that in view of the things their eyes had seen and their ears had heard, "no man can say that anything is impossible!"

What wonder, indeed, was it that men declared that it might yet be possible to talk to Mars if it were inhabited; what wonder that they had come again to believe in fairies—only that these fairies were no longer creatures of the unseen world—but men with super-minds like Marconi, Vail, Carty, and Graham Bell; what wonder that men pronounced what they beheld as latter-day miracles, or that many men and women present felt that they were dining amid scenes closely bordering the supernatural!

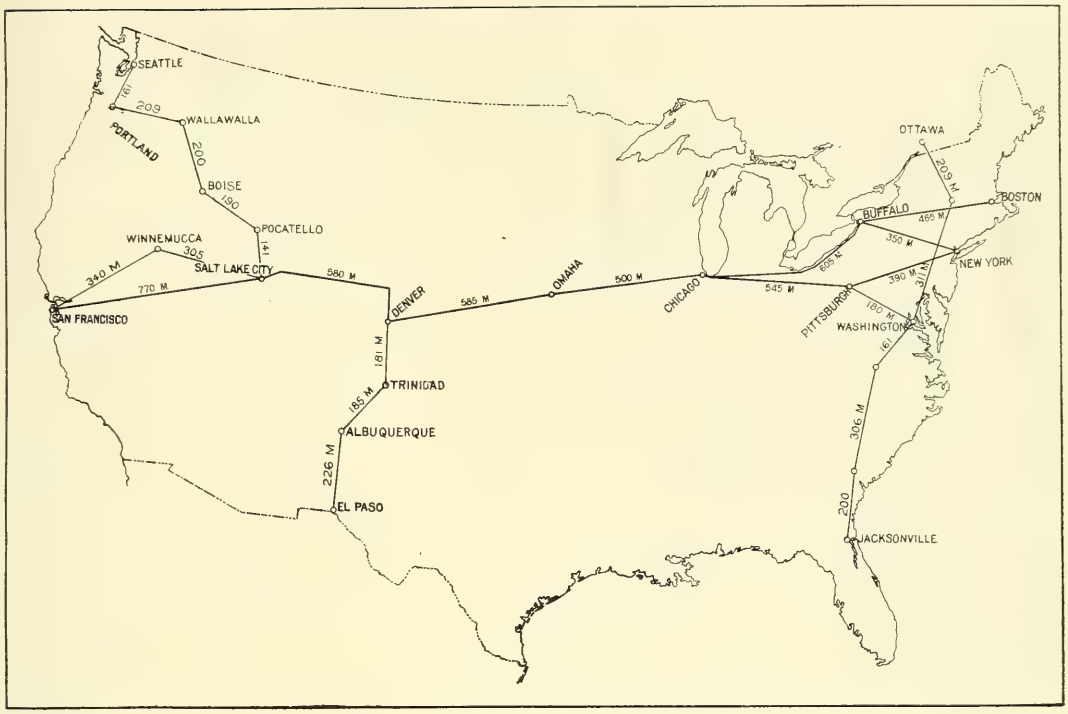
For had they not heard the living voice across a continent! Had they not had brought home to them the fact that in the twinkling of the eye their voice had swept from sea to sea, across high mountains, low plains, prairies, and plateaus!

Had they not heard the Pacific's surf beat upon its rockbound coast, while they themselves were on the very threshhold of the Atlantic!

Had they not, indeed, heard and added their own voices to the strains of the Star Spangled Banner played by a phonograph at Arlington, Virginia, and carried to New York by wireless and back to Washington by wire, in all its sweetness, with all its inspiration, and breathing patriotic faith—carried there at a speed that made the "wings of the wind" a misfit metaphor!

Think of a diner in that banquet hall hearing the strains of that music, after they had traveled four hundred miles, half way by wire and the other half by wireless, before they could reach the ear of a person at the very foot of the tower whence they started!

The dinner was given in honor of the achievements in the art of telephony



MAP SHOWING VOICE VOYAGES MADE BY THE NATIONAL GEOGRAPHIC SOCIETY FROM WASHINGTON TO PITTSBURGH, CHICAGO, OMAHA, DENVER, SALT LAKE CITY, SAN FRANCISCO, PORTLAND, SEATTLE, EL PASO, OTTAWA, JACKSONVILLE, AND INTERMEDIATE POINTS

through the forty years that have passed since Alexander Graham Bell first solved the problem of sound transmission by electricity.

The telephone paid tribute to Dr. Bell, its father, by transmitting with equal fidelity the sound of music, the roar of breakers, and the intonations of the human voice. It paid its tribute to President Vail by proving that it indeed had grown to be a national institution in its geography, in its use, and in its possibilities. It paid its tribute to the great engineering staff, headed by John J. Carty, by demonstrating that it had, through them, ceased longer to be dependent on wires, but could now make the Hertzian waves its messengers—messengers which can travel eight times around the earth between the beats of the human heart.

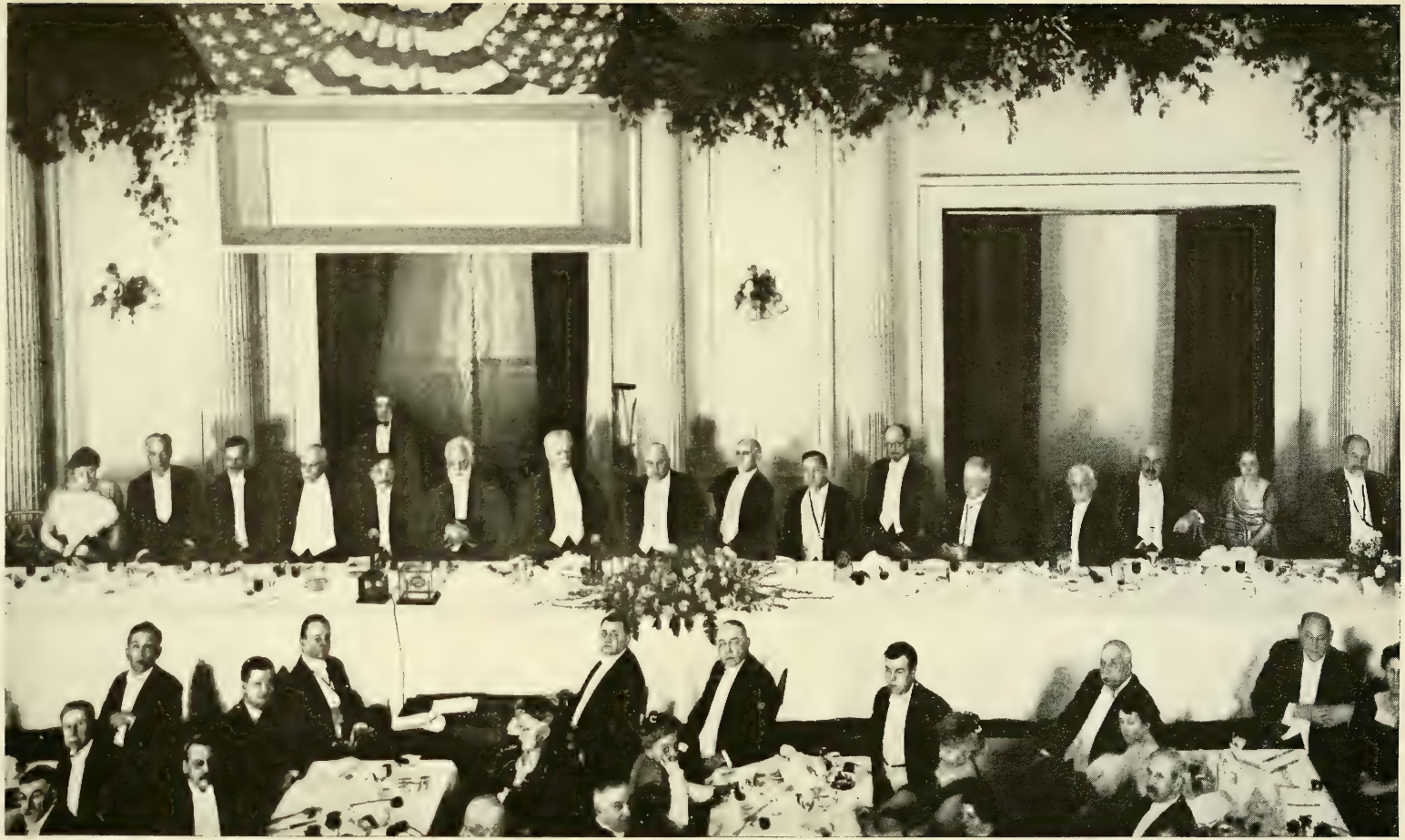
The big banquet hall of the New Willard is nearly a city block long and perhaps sixty feet wide. Eight hundred people were seated around the tables of the huge gridiron, each with a telephone receiver at his elbow. At the one end of the great hall was a large map, with electric lights marking every junction station on the transcontinental voice highway, from Florida to Puget Sound and from Ottawa, Canada, to El Paso, Texas.

VOICE VOYAGES TO SEATTLE

After the courses had been served, the chief of the engineering staff of the American Telephone and Telegraph Company, Mr. John J. Carty, announced that the assembled guests would take a voice voyage to Seattle, Washington. Eight hundred receivers went to eight hundred wondering ears and the transcontinental roll-call began.

"Hello, Washington, D. C.," said Mr. Carty.

"Hello, Mr. Carty; this is Washington; Truesdale speaking," came the answer. And the bulb indicating the Nation's Capital on the electric map grew bright.



Photograph by Frederick Schutz

SOME OF THE GUESTS AT THE SPEAKERS' TABLE

Left to right: Mrs. Franklin K. Lane, Mr. Thomas A. Watson, Mr. Gilbert H. Grosvenor, Editor and Director National Geographic Society; Major General Hugh L. Scott, Chief of Staff and Acting Secretary of War; Mr. John J. Carty, Chief of the Engineering Staff of the American Telephone and Telegraph Company; Dr. Alexander Graham Bell; Mr. Theodore N. Vail; Secretary of the Interior Franklin K. Lane; Mr. O. H. Tittmann, President National Geographic Society; Secretary of the Navy Josephus Daniels; Mr. U. N. Bethell; Postmaster General Albert S. Burleson; Rear Admiral Colby M. Chester, U. S. Navy; Mr. N. C. Kingsbury; Mrs. Albert S. Burleson; and Senator Joseph E. Ransdell. The square, dark "box," with cord attached, in front of Mr. Carty, is an exact duplicate of the first Bell telephone. Through this instrument Dr. Bell talked from New York to San Francisco when the transcontinental line was opened January 25, 1915 (see pages 313 and 315).

"Hello, Pittsburgh," called Mr. Carty.

"Hello, Mr. Carty; this is Pittsburgh; Meighan talking," came the reply.

"What is the temperature there?" inquired Mr. Carty, "and the weather?"

SPANNING THE CONTINENT

One by one, without a moment's loss of time, they came in—Chicago, Omaha, Denver, Salt Lake City, Pocatello, Boise, Walla Walla, Portland, and finally Seattle—and in the time that it takes to tell it the guests had swept on an ear voyage to the Northwest Pacific region, and 11 twinkling lights aglow on the electric map showed in how many places the diners had been transported as hearers in those few minutes. In truth, the human voice was speeding from ocean to ocean, stirring the electric waves from one end of the country to the other, and greeting every ear that was on the line to hear.

GREETINGS FROM CANADA

After thus sweeping across the continent, the dinner party started upon an invasion of foreign soil. In less time than it takes to tell it, the voice dispatchers had perfected a through route from the capital of the greatest nation to the capital of her greatest neighbor. Washington was in whispering distance of Ottawa.

And from Ottawa came messages of international amity and good-will that were heartily reciprocated by all present. "The Postmaster General of Canada sends greetings," came the voice from Ottawa, "to the Postmaster General of the United States, and trusts that for the common good of the two neighboring peoples the cordial relations which have always existed between the two departments will endure for all time."

And then from the Rt. Hon. Sir Robert Borden, Prime Minister, came hearty greetings to the National Geographic Society, a tribute to its work, and a word of hope and forecast for its future.

"My greetings," read the message, "to the National Geographic Society and my congratulations on their achievements of another successful year. In speaking through word of mouth across so many miles, it is a pleasure to recall that the distinguished scientist and inventor who has made this wonderful feat possible and who has been one of the guiding spirits of your Society has also had ties of close association with Canada. One of the objects of the National Geographic Society is to increase our knowledge and comprehension of the various countries of the world. The value of such knowledge is inestimable, and I would bespeak for your efforts an even greater influence and appreciation in the future."

FROM THE MEXICAN BORDER

"There shall be no North and no South," declared a patriot years ago; and there was not at the Geographic dinner, for as soon as the voice-visit to Ottawa was over the party proceeded to the Rio Grande at El Paso. Flashing by Pittsburgh, Chicago, Omaha, Denver, Trinidad, and Albuquerque with a word of greeting to each, Washington was in a minute speaking into the ears of men hundreds of miles apart and hearing a chorus of voices from five different States.

"Is General Pershing there?" inquired Mr. Carty of El Paso.

"Yes, sir," answered Mr. Roach, several thousand miles away.

"Hello, General Pershing!"

"Hello, Mr. Carty!"

"How's everything on the border?"

"All's quiet on the border."

"Did you realize you are talking with 800 people?"

"No, I did not," answered General Pershing. "If I had known it, I might have thought of something worth while to say."

"Well, you know it now, so you can say it," advised Mr. Carty.

"My greetings to the National Geographic Society. I have attended some of its great dinners and know what impressive functions they are. I am a member of the Society and esteem it a rare privilege to help further its splendid work."

And there were cheers at the sentiment, just as though the words had come from the speakers' table instead of from El Paso.

"General Scott, Acting Secretary of War and Chief of Staff, is here, General Pershing," said Mr. Carty, "and he will talk with you."

But General Scott was too modest. He could fight Indians, put an army through its maneuvers, and march into the "inferno of a fight" without turning a hair, but he could not talk to one of his generals over a telephone on such an occasion as this.

After El Paso, Texas, came Jacksonville, Florida, and while a chilling March rain was falling in Washington it was a balmy summery night in Jacksonville, with the thermometer registering 70-odd.

And then the tide turned again. A switch in Washington moved and the voice-tide turned from the far Southeast to the extreme West. To Salt Lake City the route was the same as we had taken to Seattle, but there a switch was thrown and we were routed to San Francisco.

When we got there lights were shining on the electric map at 21 places in 17 States and one foreign country. We had visited them all on our dash around the country on the wings of the electric wave.

When we arrived in San Francisco, the toastmaster, Secretary of the Interior Franklin K. Lane, informed that city that the whole National Geographic Society envied those who lived there.

And then came Captain Gilmer, U. S. N., to the San Francisco telephone, and soon the head of the Navy at the Atlantic seaboard was conversing with one of his captains on the Pacific seaboard as though they were in adjoining offices instead of thousands of miles apart.

A VOICE FROM THE GOLDEN GATE

And then the voice of war yielded place to the voice of filial affection, and out of the Washington receivers floated a piping "Hello, mamma! How are you and daddy? I'm just fine." It was little Larry Harris, five years old, in San Francisco, calling to his mother, who, visiting in Washington, was one of the guests attending the Society's dinner.

Mrs. Lawrence W. Harris: "Where is King? Is King there?"

King: "I am, mamma."

Mrs. Harris: "Hello, King; how are you? King, we will see you in about two weeks. Your daddy wishes to speak to you."

Mr. Harris: "Hello, King; how are you, my boy? Who are you with?"

King: "I am with grandma."

Mr. Harris: "Well, you tell your grandma that this is no time for her to be out. Good-bye, boy."

Mr. Carty: "Mr. Harris didn't realize that it is now only half-past seven in San Francisco."

The voice of the little fellow and his brother King, age three, captivated 800 people and brought earnest applause as they at half-past seven in San Francisco said good-night to their parents at half-past ten in Washington.*

After the conversation was done, Washington began to say good-night to all of the stations with which it had talked, starting with San Francisco and coming east.

"Good-night, San Francisco," said Mr. Carty.

"Good-night, Mr. Carty," answered San Francisco, as her light on the electric map became dark. And so we said good-night to all of them.

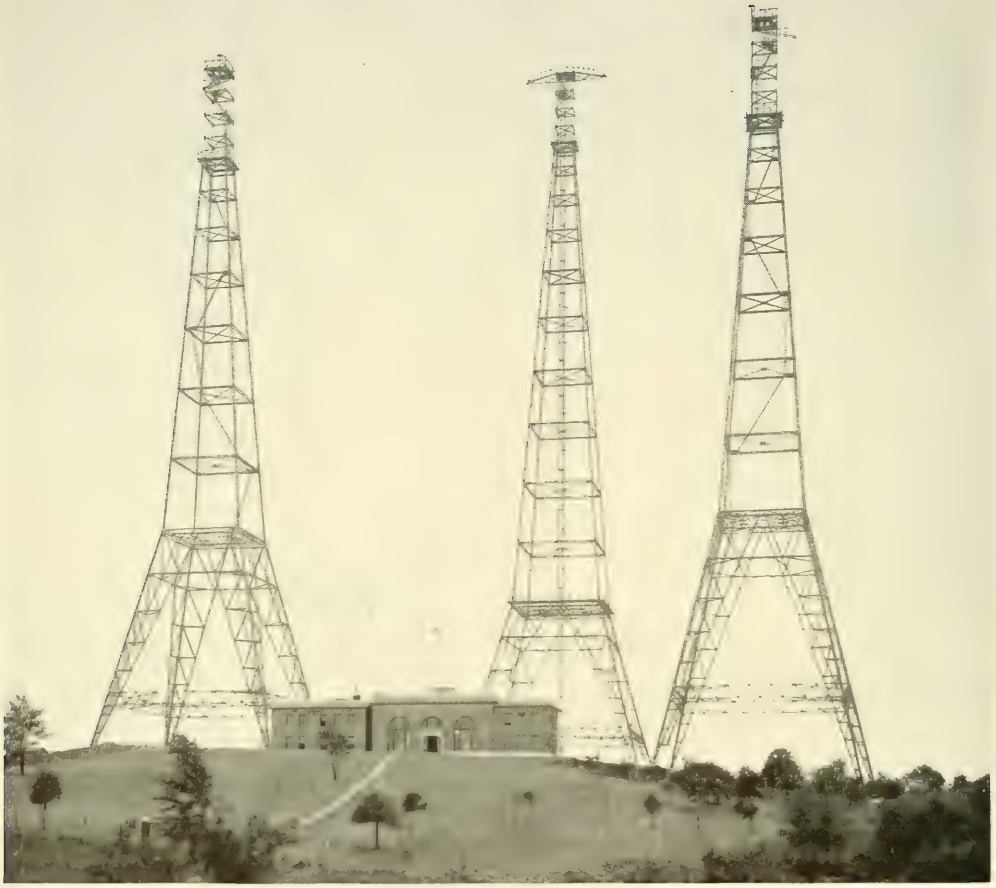
TALKING WITHOUT WIRES

And then came a new series of demonstrations. Up to that time we were talking over wires. The messages were not free to move anywhere but along particular wires to particular places.

Now sounds were to be mounted on steeds of inconceivable fleetness and dispatched through the circumambient to everywhere in general and New York in particular.

* This was not the first time that a youngster had talked across the continent, however, for the very first child's voice flashed through the transcontinental wires was that of Melville Bell Grosvenor, grandson of Dr. Alexander Graham Bell, at the opening of the New York - San Francisco telephone, January 25, 1915.

Little King Harris, aged three, and his brother Lawrence, aged five, in San Francisco, are saying good-night to their father and mother, who, 3,000 miles away, are guests at the National Geographic Society banquet in Washington, D. C. (see page 300). It is 7.30 p. m. in San Francisco and 10.30 p. m. in Washington, D. C.



Photograph by Harris & Ewing

THE ARLINGTON WIRELESS STATION

It was from these towers that the human voice was heard nearly half way around the earth, when Mr. Espenschied, in Honolulu, overheard Arlington talking to Mr. Shreeve, in Paris (see pages 303 and 314).

When a wireless telephone turns loose a word into space, it does not travel through a lane to the point of destination; rather it spreads itself north, south, east, west, and literally fills the air with sound; so that we might, instead of "Those who have ears, let them hear," now say, "Those who have wireless telephones, let them hear." That is why Honolulu was able to eavesdrop on a conversation between Arlington and Paris. Dr. Bell has surely brought the eavesdroppers into their own when he has made it possible for them to hear in Honolulu what Washington says to Paris.

The first of these demonstrations was the talking over a circuit made up of two sections of wire and one of wireless. The banquet-room was connected by wire with Arlington wireless station. There the messages were transferred to the air. At New York they were picked up again by the wires and brought back to the banquet-hall.

And as people at the far ends of the hall held their receivers to one ear and listened to Mr. Carty and Secretary Lane talk into their telephones, the sound in the receiver seemed the voice, and the sound in the air the echo, so rapidly were the words conveyed on their 450-mile circuit.

THE TELEPHONE BUILDING AT EL PASO, TEXAS, FROM WHICH GENERAL PERSHING TALKED TO THE 800 MEMBERS AND GUESTS OF THE NATIONAL GEOGRAPHIC SOCIETY BANQUET AT WASHINGTON, D. C.

A NATION'S HEART BEAT

But this was not yet the supreme test—the test that brought the guests to their feet with hearts beating fast, souls aflame with patriotism, and minds staggered as wonder had followed wonder as minute followed minute.

Now a screen was stretched across the end of the banquet-hall, a moving-picture machine was wheeled into action, and the Star Spangled Banner flashed its thrilling beauty upon the screen.

Over at Arlington wireless station a phonograph began to play. Out of its vibrant throat leaped a nation's patriotism expressed in song. A wireless transmitter gathered the notes and gave them to the Hertzian waves. The sounds that the phonograph itself released into the air were soon lost. They were as much slower than the wireless impulses they started as a snail is slower than the fastest big-gun projectile.

For nature made sound travel 360 yards a second, while the wireless telephone has given it a speed of 186,000 miles a second. Thus a wireless message envelops the whole earth in the time that a sound in its native element spreads over a circle 144 feet in diameter. Dr. Bell has made the human voice able to travel nearly a million times as fast as it could before he invented the telephone.

It was less than the proverbial twinkling of an eye between the utterance of the sound by the phonograph at Arlington and its receipt in the 800 receivers in the banquet-hall; and as it floated in gently and softly, yet clearly and impressively, its stirring appeal moved every

BUILDING TRANSCONTINENTAL TELEPHONE LINES UNDER DIFFICULTIES

In hauling the heavy redwood poles over the western desert the construction gangs have to build their own roads

soul to song, and the hundreds present joined in our national air:

"And the Star Spangled Banner in triumph shall wave
O'er the land of the free and the home of the brave."

It was an inspiring moment, quickening the pulse, electrifying the mind, and causing waves of enthusiasm to sweep over the banquet-hall as billows over the sea.

It was then that Dr. Bell exclaimed: "We have just been hearing 'The Star Spangled Banner' by wireless and the audience has joined in singing it. It occurs to me that by means of the telephone the millions of people of the United States may soon sing 'The Star Spangled Banner' all at the same time."

And then came the speech-making; but it was a subdued, an overwhelmed, a reverent audience that the speakers addressed. The spirit of mirth and levity had no place among people who had witnessed such marvelous exhibitions.

ADDRESS OF THE TOASTMASTER, HON. FRANKLIN K. LANE, SECRETARY OF THE INTERIOR

I do not know how you feel after the exhibition that has just been given to us, but for myself I can say that I feel humbled and meek and overwhelmed, for no man can say, after the things we have seen, after the things that we have heard, that anything is longer impossible.

They tell me that this is a cynical age—an age that is materialistic and without faith—but, standing in the presence of these miracles, these wonders, I say to you that it is, above all ages, the age of faith.

No man can say that it will not be possible at some future time to talk, as I threatened to talk tonight, to the planet Mars. There is probably not one man or woman here who, forty-five years ago, would have said that it would ever be possible to talk across this continent by wire, much less to talk to New York and back again to this hotel by wireless. This age is not cynical, is not without faith. The motto of this age might very well be the words from Peter Pan. We do believe in fairies. The only difference is that we have changed the kind of fairies that we believe in, and instead of believing in Hop-o'-my-Thumb and Jack of the Beanstalk, we believe in fairies like Marconi and Pasteur and Carty and Graham Bell.

We live in a city that is studded about with statues of men who have made large sacrifices and done great service for our country, statues of our generals, crowned by that wonderful monument that pierces the sky, to the man that led us in our fight for independence; and soon we will add to that the great Greek temple that is to be forever a monument to the man who kept this Union for us.

But where are the statues to the men who have made America? Where are the statues to the men who are the inventors and the engineers and the discoverers of this continent? Out of my office every day go 250 patents. Our people have the greatest resources of any people in the world, not in their soil—although that is without equal; not in their minerals—though no other nations can rival us as to minerals—but in the inventive genius of the American mind, which we honor tonight.

Other countries do honor to men of this class. They may command a knighthood or a baronetcy. We cannot indulge in such luxury, but the National Geographic Society can hold a banquet in honor of such men and crown them with the laurels of our affection and admiration.

THE INGENUITY OF MAN

The men who make this world and the men who serve this world are preëminently the men who work in laboratories and in workshops. The boys across the water may believe that theirs is the real conquest of the world; but it is not so. The world is being conquered by the mind and the ingenuity of man.

In Paris there are two monuments that have always attracted my attention—the Tomb of Napoleon, which every one sees; but behind the dome of the tomb there is a modest statue to Pasteur, a man whose name will be remembered when the names of generals and monarchs and emperors are forgotten, and on the front of that monument there is a picture of a girl, the statue in relief of a girl just rising from her bed, leaning against her

mother, and the mother is looking up in gratitude in Pasteur's face above, while in front of her the figure of Death slinks around the corner of the statue. To such men should our monuments be given, because they are those who conquer this world.

BATTALIONS OF COMMERCE

But it is not for me to talk to you tonight, but to give you an opportunity to see those who have done things. This is a city of almost perennial talk, and it is proper that such an exhibition of the telephone should be given here. But it is not often that we have an opportunity to see those men who have throughout half a century given their genius to our country and made it distinct on the face of the earth. One of the rarest qualities in man is the genius for organization, and I want to present to you a man who has under his direction tonight 250,000 men and women—the man who came from a department of this government forty years ago, and who has organized the greatest telephone system in all the world—Mr. Theodore N. Vail.

ADDRESS OF MR. THEODORE N. VAIL, PRESIDENT OF THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY

This splendid compliment to "telephony" and to those identified with it, coming as it does on the official birthday of the telephone, is most highly appreciated by us all, and recalls to me many points of mutuality.

The home of the Society is in the beautiful "Hubbard Memorial." Mr. Gardiner G. Hubbard, the father of the telephone business, was the sponsor and father-in-law of Dr. Bell, inventor of the telephone, was one of the godfathers of this great Society, and grandfather-in-law of Gilbert H. Grosvenor, the man who has done so great a work in the development of the Society and of its Magazine, devoted to the spreading of geographical information. The part taken by Mr. Hubbard in laying the foundation of the existing telephone business, in opening up the vista through which we could all see its future, and the contributions made by him to the general business policy which has had so essential a part in the greatness of the business can never be overstated.

As general superintendent of the railway mail service, I was brought into intimate personal contact with Mr. Hubbard, who was the chairman of a commission created by Congress to investigate and report upon the then aspects of the always-with-us controversies over the compensation of the railroads for transporting the mails. Congress had recently made a horizontal reduction. On the trips of the commission over the country Mr. Hubbard carried with him a few telephones, and without neglecting the work of the commission, he at every opportunity exhibited and explained this marvelous invention. We discussed the business, its possibilities and potentialities, and the policies which should underlie its development, so that my connection with the telephone may be said to date from its inception.

THE GLORIOUS CAREER OF AN UGLY DUCKLING

The apparatus was extremely crude and very unsatisfactory. A child never was born with less apparent promise of the destiny it has attained. Yet there never has been a discovery or an invention that in the short life of forty years has so revolutionized that with which it has had to do (see page 310).

The four associates—Bell, Hubbard, Sanders, and Watson—who were behind the telephone, under the leadership of Mr. Hubbard, started the business in 1877. The first corporations which brought capital and organization to practically and systematically exploit the business were formed in 1878.

To look back on those days, it seems as if they had covered ages; yet it was but three years, from 1876, the natal year of the telephone, to 1879, the year in which the settlement with the Western Union was made, and the first big hill in the life journey of the telephone was crossed. At least two of these three years were employed in teaching the telephone itself how to talk intelligently and satisfactorily; for not until 1878

THE NEW WAY IN TELEPHONE LINE CONSTRUCTION

Motor trucks are used to haul a derrick from hole to hole, and four men can do the work that formerly required a dozen. The Bell Telephone System has spent twice as much money in the same length of time (1906-1914) for the extension of the telephone service of the United States as the United States government has spent for the construction of the Panama Canal (see page 322).

Photograph by George J. Hare

A TELEPHONE BUILDING IN BUFFALO, NEW YORK

It is in such modern structures as this that the great "union stations" of the telephone world are found. Trains of electric impulses are dispatched to all parts of the continent from them. "New York City alone, exclusive of its suburbs, has twice as many telephones as the whole of France, nearly one-half as many as the German Empire, and quite as many as the whole of Spain, Portugal, Switzerland, Italy, Greece, the Balkan States, Turkey, and Russia combined" (see page 321).

was a practical, commercial, dependable, usable instrument developed.

From the settlement with the Western Union the history of the business is well known; its progress is familiar to you all, and this evening you have had a demonstration of what can now be done and indications of future possibilities.

THE BATTLE OF DAVID AND GOLIATH

The most important single event in the history of the telephone business may be of interest.

The telephone patents had been offered to the Western Union, but the offer was declined. Through the Gold and Stock Telegraph Company, the Western Union was doing a profitable local private-line business, using printing telegraph instruments. The first development of the telephone was for use on private lines, replacing the printing instruments. When the Western Union realized this, to protect its business, it entered the telephone business in competition with the Bell, operating under various patents which it claimed were independent of the Bell patents.

The Bell interests were devoting their energies to developing telephone-exchange business. The Western Union, through its prestige and power, had for a little while a seeming advantage. The fight was a David and Goliath affair. The Western Union was the largest and most powerful corporation of the time—relatively greater than anything that exists today.

Eventually a compromise was proposed. The Western Union believed the great future of the telephone to be in private-line use; the Bell believed it to be in the exchange service, which is in fact a system of private lines from the central office to each subscriber. By means of switchboard and trunk lines any subscriber's private line can be connected with any other subscriber's private line, constituting a private line from subscriber to subscriber.

The negotiations hung on the condition denying to the Bell interests the right to connect their exchanges by means of toll lines. Few had faith in the future of the toll lines or their value as compared with the private lines, but if long-distance conversation should be developed the Western Union feared it might be a menace to the telegraph business. Time has demonstrated that the telephone can never be substituted for the telegraph instrument; that the long-distance telephone is not competitive with telegraphy, but has a distinct field of its own; that the telephone system is supplementary to, not competitive with, the telegraph system.

The prospects for the future of toll lines or distant speaking—the idea of carrying the voice any great distance—met with little serious consideration, and the idea of speaking across continents met with ridicule. Our engineers, at a considerably later period, thought it might be possible to talk to Chicago, if we had a big enough wire; but the bigness was prohibitive.

The conferees of the Bell were divided about the toll business; some of them tired of the contest, preferred half a loaf in peace and comfort, rather than a struggle for a whole loaf; if yielding would bring about a settlement, some were willing to yield. To me the idea of yielding the toll-line use meant the curtailment of our future, the absolute interdiction of anything like a "system."

At the end of a nearly all-night session on one of the Sound boats en route for New York, we had a unanimous committee, who determined the Bell should retain the exclusive and unlimited right to telephones for exchange service with a 15-mile radius, and for conversational purposes, any distance, but willing to yield to the Western Union the exclusive right to the telegraph business and to private lines. On this the Bell stood, except that the private-line right was made non-exclusive, and the settlement made on these lines determined the basis for the telephone development.

THE REWARD OF RESEARCH

The present development of the telephone is not due to disunited effort, although many and valuable suggestions and inventions have been either concurrently or independently developed outside the Bell system. It is due to the centralized, coöperative coördinated work of the

departments of operation with the departments of engineering, experiment, research, and development—of the whole Bell system. Research, investigation, experiment, comprehensive and thorough, are now necessary to hold any position in any industrial or utility enterprise, and those on a large, comprehensive scale are enormously expensive.

This centralization has produced a high and most completely developed system; beyond every point that has been reached there have always been possibilities of something greater, and these possibilities have been the goal of every one connected with the business.

It is a unique coincidence that the two epoch-making inventions which created the art of electrical transmission of intelligence were made by men absolutely outside the field of electricity. Professor Morse was an artist. From his reading of Professor Henry's discovery of the magnet and the possibility of controlling its action from a distance, he conceived the idea of transmitting combinations of signals, to be interpreted into figures, letters, words, sentences. He had no scientific or mechanical education or training and little money. He found in Alfred Vail an assistant, one who had a scientific education, mechanical training, skill, and ingenuity, who had a father with common-sense enough to believe in the idea, money and courage enough to finance it.

ONLY ONE MAN ON THE RIGHT TRACK

There were many working on the multiple telegraph, but from different standpoints and for different purposes—among them Professor Bell. He had in Watson a trained mechanic, and in Hubbard and Sanders believers and capitalists. Bell was not an electrician, but was trained in articulation and the science of speech. His powers of observation, and particularly of perception and deduction, were great. In his telegraph studies and experiments he observed some phenomena from which he evolved the idea of the telephone, and when he recognized in the vibrations of the reed the peculiar timber of vocal speech he knew he had the solution.

There was no one working on the speaking telephone, except Professor Bell, who could have invented it. They were approaching the subject from the standpoint of electricity without the knowledge of acoustics or the requirements of speech production, or the character of vocal vibrations, of which Bell was the master. This knowledge was the key to the invention.

It was so simple that all wondered at it, and so seemingly impossible that all ridiculed it; but so soon as it became of utility many claimed, copied, and pirated it.

There was not and never has there been any telephone made which is not based on Bell's patent, and, with the exception of what Berliner contributed, his invention contained all that is essential in the instrument in use today; and yet the only time when Bell was the undisputed inventor of the telephone and the Bell Company without opposition was during the year 1876, before its commercial value was recognized, although every one acknowledged its scientific importance.

GEOGRAPHY AND THE HUMAN VOICE

The Geographic Society has a symbolic picture with the inscription, "The Geographic brings all the world to you." It might be said that the telegraph brings all the world into immediate communication, and the telephone fetches your voice and conversation to the world.

Geography establishes position and determines distances; discovers the potentialities of the world and reveals the paths of intercommunication.

Geography may be termed the anatomy, transportation the veinous or arterial system, and telephony and telegraphy the nervous system of the world and its economic and social structure.

Intercommunication, of which the telephone is the latest exponent, binds this world together, draws its interests closer, and will in time create a condition wherein all interests will be common to all people.

Common interests, patriotism — the bases of all communities, commonwealths, or nations—can only permanently exist where there is common language. Natural and permanent boundaries of nations are so established.

Photograph by M. Rosenfeld

MANHOLE WITH CABLES READY FOR SPLICING

These huge cables are each made up of thousands of insulated wires sheathed in lead and carried into the telephone exchanges. The largest cables used contain 2,400 individual wires.

Geographic science is fast revealing the world and its possibilities and potentialities; intercommunication is fast utilizing these discoveries and making necessary to all people common language or common understanding of languages, and when that common understanding comes, which is bound to come with free exchange of thought and ideas, then will come a common brotherhood.

GEOGRAPHY DISSIPATES SUPERSTITION

It will take time to overcome the force of inertia which binds the man to the inherent, inherited, inbred ideas, traditions, prejudices, habits, conventionalities, which endure through generations and are overcome only by new experiences, new knowledge. Some term this conservatism, but it is nothing but the inertia that comes from lack of a new knowledge vivified by new experiences.

Geography reveals the world and makes it real; it dissipates the haze and fog of superstition and tradition, attracts and encourages the travel which brings expansion. In this vast field there is abundant room for practical, constructive imagination to work. The immediate future is only dimly outlined by the light of past experience and present knowledge; the distant future is still in the shadowy haze of uncertainty, speculation and doubt; but, though it may be too optimistic and too hopeful, there seems to me no doubt but that progress in the future will be as marked as in the past.

There can be but few great developments in the future of which the beginnings have not been made or have not been foreshadowed. Each age has believed it had reached the acme of evolution in economical, commercial, and artistic lines, and that but little more was possible. In "transportation" the newly introduced stagecoach of the eighteenth century gave way to the steam railroad expresses of the nineteenth century; and electrical and aërial transportation are dawning in the twentieth. In "intercommunication" the signal lights of the Middle Ages gave way to the semaphore of the eighteenth century—the electric telegraph of the early, supplemented by the telephone in the late, nineteenth century. And in the twentieth comes the dawn of transcontinental, transoceanic, and circum-mundane electrical intercommunication and conversation!

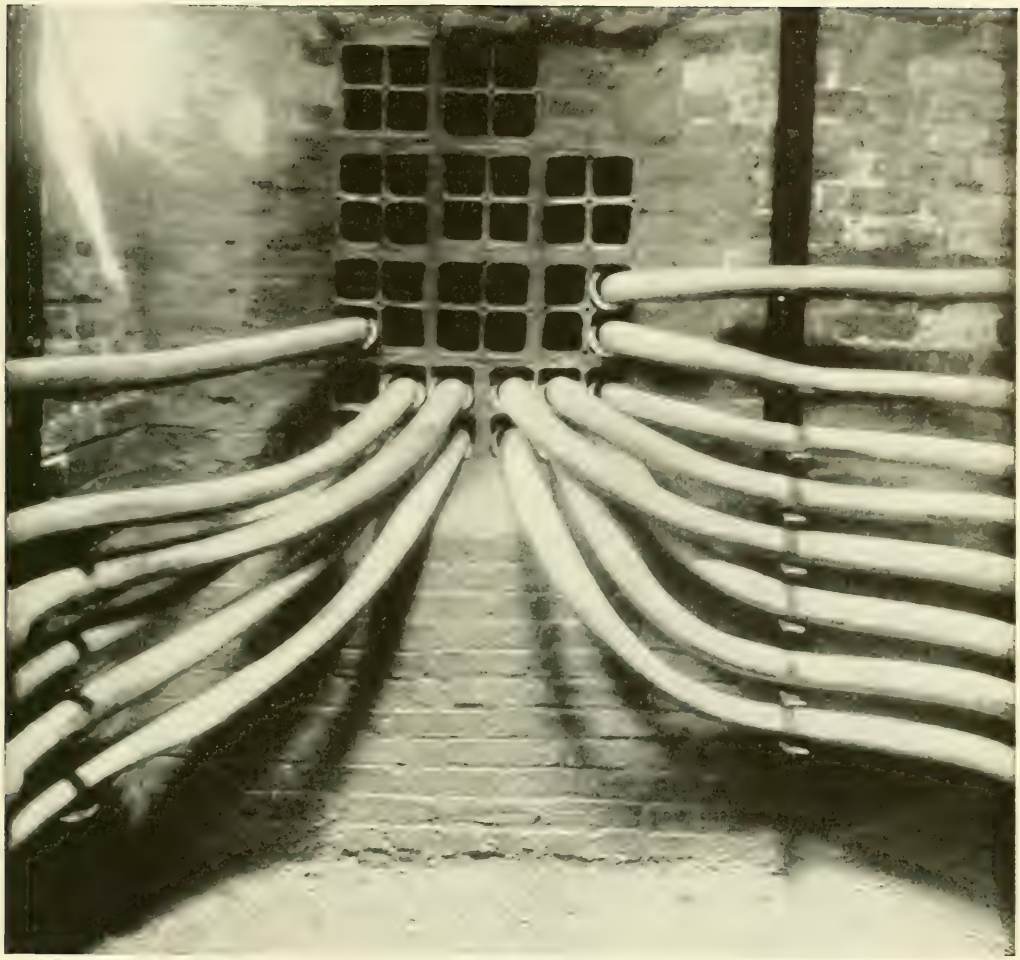
When Mr. Bell and Mr. Watson first talked in public over the telephone, or Mr. Hubbard first tried to interest constructive interests in the new "Yankee toy," if either had prophesied as possible what actually exists today, he would have been laughed at. Those who laid the foundation of the business could well define the structure, but its magnitude has far surpassed expectation. When my connection with the telephone was announced, one who was then a Representative and afterward a Senator and a Cabinet Minister, whose name always commands respect, said to me: "Vail, that isn't a big enough business for you." Consider that in the light of today!

SOME DAY WE WILL BE ABLE TO TELEPHONE TO EVERY PART OF THE WORLD

Is it too much to think that in time it will be possible for any one, at any place, to immediately communicate with any one at any other place in the world by reasonably available methods; that distance will be annihilated and the whole world will be united in common interests, common thought, common traditions, and prejudices? Then and only then can there be a common people.

The wonderful work that geographical research did in opening up the unknown world in the late seventeenth, eighteenth, and early nineteenth centuries presented a new field to the people of initiative and enterprise, of an Old World already bursting its confines by its overdevelopment.

This world development, for which geographic research is largely responsible, is in turn responsible for the magnitude of present operations, economic and social. This immensity is constructive, not destructive; is something to be welcomed and encouraged rather than persecuted and destroyed. It is something



THE MAIN LINES OF THE VOICE RAILWAY WORLD (SEE ALSO PAGE 311)

which is uplifting all men, raising them up to higher levels and possibilities, and is neither oppressing nor taking away from man any possibility of greater enjoyment or of better things. It is bringing to him and within his power of acquisition those things which were formerly for the few. It is making possible all things that can bring the extremes of mankind nearer together.

A WORLD-WIDE BENEFIT

This economic industrial development of the world is caused by that coöperation, that coördination of effort which assigns to individuals the tasks and duties for which each is best fitted, and in this way gets the most out of the efforts of all. It will not, nor can anything ever make any one independent of individual effort or raise any one above his inherent possibilities.

This development is so infinitely greater than that of the past, and has come so much faster than the minds of men could possibly become adjusted to it, that there has been no standard familiar to man's mind by which to measure it. The abuses which always accompany any movement, great or small, are looked upon as integral elements of them, not merely incidental. These misunderstandings, the inclination to introduce repressive and corrective measures, where only directive measures are wanted, are caused by the *vis inertia* of men's minds and the im-

Photograph by M. Rosenfeld

CHELSEA TELEPHONE EXCHANGE: NEW YORK CITY

A hundred dispatchers here handle the thousands of trains of talk that hourly pass through the big terminal. "Is it too much to think that in time it will be possible for any one, at any place, to immediately communicate with any one at any other place in the world by reasonably available methods; that distance will be annihilated and the whole world will be united in common interests, common thought, common traditions, and prejudices? Then and only then can there be a common people" (see page 312).

possibility of adjustment to the rapidity and immensity of the development.

When the true understanding comes, all will unite in directing and guiding and protecting; then and only then shall we reap the full benefits of man's developing powers and understanding and of man's initiative and enterprise.

ADDRESS OF DR. ALEXANDER GRAHAM BELL

I am really overwhelmed by the realization of the greatness of the demonstration that has been given us tonight. Wonderful! Wonderful! It brings back to mind the significance of the first message ever sent by the Morse telegraph, "What hath God wrought!"

I am overwhelmed in more ways than one. I do not see what I have had to do with this thing. Many, many minds have contributed to the development of the telephone of today, an army of workers organized under Mr. Vail and Mr. Carty, and the researches of the telephone and telegraph company have been required in order to bring these marvelous results.

When I try to find out what I have done and look back to the long vista of years, I see only this (*holding aloft the first telephone instrument which demonstrated the possibilities of transmitting the voice by electricity*), the original Bell telephone, Mr. Watson and myself working hard at it to make it speak. It was a most disappointing introduction to this wonderful art. Mr. Watson could always hear a great deal better than I could. He could hear phone speech sounds and occasional words, and I tell you it was a great day, on the 10th day of March, 1876, when at last there was no doubt about it; complete words and sentences were understood both by Mr. Watson and myself. I can remember very well talking into the instrument, which was connected with the next room, and said: "Mr. Watson, come here, I want to see you." And he instantly came into the room, and I was delighted to know that he had understood.

It was only a short time ago that I was talking from New York to San Francisco—Mr. Watson in San Francisco and I in New York—and I was asked to repeat the same sentence which was the first to be transmitted over and through this instrument itself, and I put my mouth to this old telephone in New York and called out to Watson in San Francisco: "Mr. Watson, come here, I want you." He replied: "It would take me a week to get there now" (see page 298).

Now I cannot claim very much credit for all this wonderful development. I can see this whole telephone away in the distance and extending from it an army of workers laying wires and extending the influence of the telephone, headed at first by the first President of the National Geographic Society, Mr. Gardiner Greene Hubbard. Then, as this army of workers extended to this great general, Mr. Vail, who has brought the telephone system in America to completion.

DREAMS THAT CAME TRUE

Away back in the old days I dreamed of wires extending all over the country and of people in one part of America talking to people in another part of America. It was the dream of a dreamer, but Mr. Vail has made it come true, and today we have been witnesses of the fact that there is no part of this continent that is inaccessible to the human voice. Mr. Vail has brought this instrument into every home. What would business be without it? It has even gone into warfare and into the trenches in Europe; in fact, Mr. Vail is evidently trying to make the telephone "First in war, first in peace, and first in the hearts of his countrymen." He has covered this continent with a network of wires, millions of miles in extent; he has accomplished the dream of my youth of the wires that should cover this land.

But our good guest of the evening, Mr. Carty, is going further than this and he is getting out all the wires. It was only a few weeks ago that Mr. Carty and his associates demonstrated the possibility of wireless telephony by talking from Arlington here to the Eiffel Tower in France, and a man in Honolulu overheard the conversation.

Where are wonders going to cease? Why, that is a distance equal to one-third of the circumference of the globe. Is there any part of the globe that Mr. Carty

may not reach by telephone and without wires at all?

I am struck to the heart to meet my old friend, Mr. Vail, for we have not met since we were young men, and we are not so very old now. Yet we look forward to see what Mr. Carty and his brilliant associates of the American Telephone and Telegraph Company will bring forth in the future.

ADDRESS OF MR. JOHN J. CARTY, CHIEF ENGINEER AMERICAN TELEPHONE AND TELEGRAPH COMPANY

There are many who are yet to speak to us, and as I have already spoken so many times this evening and to so many places, I must be brief in what I have to say now.

These demonstrations in which you have all taken part tonight are not the result of the work of any one man; they are made possible by a long line of investigators, beginning with Dr. Bell himself. For my own part, I am fortunate in being the chief of the large staff of engineers and scientists which has put into practical form and placed at the service of the public these marvelous developments which have been exhibited before us tonight.

Some of these men, I am glad to say, are present with us. There is Mr. Shreeve, who, at the Eiffel Tower, heard the first words spoken across the Atlantic. Mr. Espenschied, who was stationed at Honolulu and heard Arlington talking to Mr. Shreeve at Paris, is on duty tonight at the Arlington Tower, where you all heard his voice speaking to me. Then there are Mr. Gherardi, Mr. Jewett, Mr. Mills, Mr. Drake, Mr. Thompson, Mr. Blackwell, Mr. Robinson, Mr. Arnold, Mr. Colpitts, Mr. Campbell, Mr. Heising, and Mr. England.

TELEPHONY IS AN AMERICAN ART

These young men all illustrate very well the character and make-up of the staff. They are all from American colleges and universities; some of them trained under Dr. Pupin, whose classic invention, the loading coil, is employed in the San Francisco line. One of these young men is a graduate of the University of North Dakota and another is a graduate of the University of South Dakota, and each has taken his postgraduate studies in another university. Instead of going to Germany, France, or England, which was formerly necessary for such advanced work, they did not have to go any farther east from the Dakotas than to the University of Michigan and the University of Chicago, where they received postgraduate scientific training equal to what they could get in the best European universities.

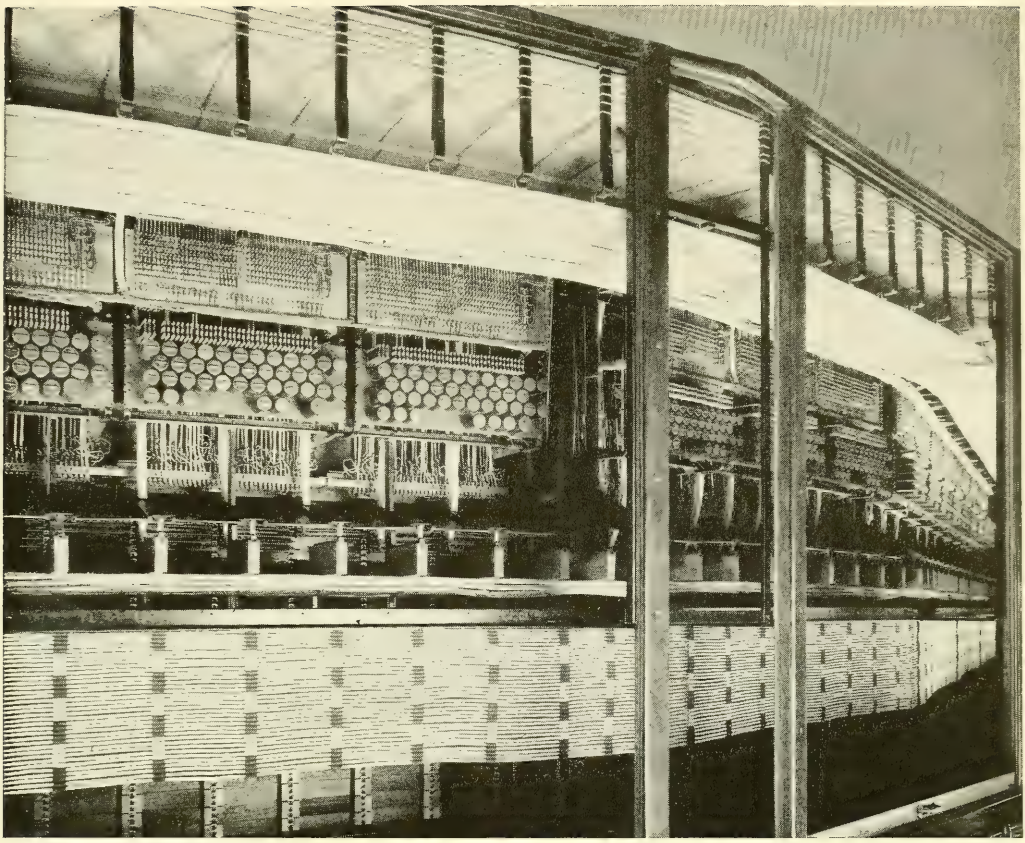
It is a most interesting and encouraging sign of American scientific development that two of these young men are from universities in North and South Dakota, States which were inhabited largely by savages at the time when General Scott was on the frontier conducting Indian warfare. There was a time when it was necessary for us to go abroad to study the arts, but in respect to one art at least the tide has turned, for in order to study the art of telephony it has long been recognized by the nations abroad that their engineers must go to America, the home of the telephone.

This splendid recognition which the National Geographic Society has accorded to American telephone achievement will be received with feelings of deep appreciation by American telephone engineers; and, speaking on their behalf, I can assure you that in the future, as we have always done in the past, we will in all things pertaining to the art of telephony keep secure for our country the foremost place in the world.

ADDRESS OF HON. THOMAS WATSON, OF BOSTON

I am very proud and glad that I was chosen by the fates to be the associate of Alexander Graham Bell in all the experiments by which the telephone was perfected.

To tell you one-half of what Dr. Bell did during the three years I was associated with him would take me the rest of the night, so I cannot do it. However, I want to describe the one incident which was very important in the history of the telephone, the night when Dr. Bell and I talked over a real outdoor telephone wire



THE REAR VIEW OF PART OF THE SWITCHBOARD SHOWN ON PAGE 314

"The two States of New York and Pennsylvania have as many telephones as the whole of Great Britain, France, Belgium, Italy, Serbia, and Russia combined, while Ohio and Illinois have as many as Germany, Austria-Hungary, Bulgaria, and Turkey combined" (see page 321).

for the first time. I made with my own hands for Dr. Bell, under his direction, the first speaking telephone the world has ever seen, but there were 16 months' hard work after that before Dr. Bell thought his baby was big enough and strong enough to talk outdoors.

On the 9th day of October, 1876, a very important day in the history of the telephone, Dr. Bell had obtained permission to use a wire running from Boston to Cambridge, about 3 miles long, and on that evening I went out with one of the best telephones that had been devised up to that date, and Dr. Bell proceeded to Boston with its duplicate. I waited out at the Cambridge factory until Dr. Bell signaled on the telegraph instrument that he was ready. I think I was then more excited than I ever was before in my life, or ever have been since, and I connected up the telephone to listen to what Dr. Bell would say, and I could not hear the faintest sound.

I shouted back in the telephone and listened again, and there was nothing but the blackest, dreadful silence. I knew that we were working against the most delicate electrical current that had ever been used for any practical purpose, and as I could not hear his voice I thought that the delicate current must have leaked off of every insulator so that none of it got across the Charles River to where I was.

I had almost made up my mind to disconnect the telephone and telegraph back to Dr. Bell that while his telephone might do very well for speaking tubes, it never would compete with the telegraph. Then

REPAIRING THE DAMAGE DONE BY SNOW AND SLEET

I happened to think that there might be another telegraph instrument connected in the circuit in some other part of the factory that I was in.

The janitor had been standing there looking at me as if he thought I was crazy, shouting into the end of the wire and expecting somebody in Boston to hear me. I asked him to show me where the wire entered the building and he did so. I traced it through the building and found another telegraph relay in the same circuit. My heart gave another jump, for I realized that there was another chance. I got it out, rushed back to the telephone, and listened.

That was the sole cause of the trouble; far louder and more distinct than I ever heard it before, Dr. Bell's voice was coming out of that instrument, and he was saying: "Watson, are you there? Are you listening? What is the matter?" I shouted back, and then ensued the first conversation that ever has been held over a real telegraph wire.

Some of Dr. Bell's pessimistic friends had been objecting and saying that the telephone would never compete with the telegraph business even if he did get it to talk over an outdoor wire; so he made an arrangement with me and I went to Cambridge, and everything I heard him say through the telephone I wrote down, and what I said to him he would write down at his end of the wire, so that the record could be put side by side to prove to the croakers that the telephone could really transmit intelligence accurately. That was done; so that first conversation was preserved, word for word.

After he finished making the record, which perhaps took a couple of hours, we were so fascinated with the joy of talking over a real telegraph line that we kept up our conversation, without recording it, until the small hours of the morning, and I can assure you, ladies and gentlemen, it was a very happy boy who wended his way back to Boston early the next morning with a telephone under his arm, wrapped up in a newspaper.

A LANDLADY WHO COULD NOT APPRECIATE SCIENCE

Dr. Bell was not at the laboratory when I got there, for he had gone to the newspaper office to tell them about the wonderful occurrence of the evening; but when he came in, so enthused and jubilant, we really danced a war-dance. When Dr. Bell used to celebrate he would do so with a war-dance, and I really got so that I could war-dance nearly as well as he. That night we had a jubilee and a war-dance that lasted for some time, and when our landlady met me the next morning on the stairs she made the remark that if we did not stop making so much noise in the rooms of nights we would have to vacate. Our landlady was not at all scientific in her tastes, and I think I remember we were a little behind in our rent.

That was the beginning of this stupendous thing we call the Bell system today, and it almost takes my breath away

to see what it has passed through. I have been out of the telephone service for 30 years, but I say it almost takes my breath to see what has been done in the years that I have been away from it; and when I think of the men in charge of this—Mr. Vail in charge of the business organization and Mr. Carty and his associates following up the technical scientific part of it—I must say that I have found boundless hopes for the future, and I can only ask in amazement what they will next do. I thank you.

ADDRESS OF UNION NOBLE BETHELL, SENIOR VICE-PRESIDENT OF THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY

While I am in entire accord with Mr. Carty in his characterization of the telephone art as an American art, when he was talking I could not but think of something which is said to have happened recently in the capital city of Pennsylvania. A number of citizens of that great Commonwealth were gathered together, and were congratulating themselves upon the greatness of their State and the number of its sons who had attained prominence throughout the nation and throughout the world. At length one of the number said to his brethren: "Gentlemen, I desire to propose a toast to that greatest of Pennsylvanians, Benjamin Franklin, of Massachusetts."

A FITTING TOAST

So I think it entirely proper and fitting for us on this occasion to extend our congratulations and felicitations to the foremost figure in the creation of this American art, that distinguished American, Dr. Graham Bell, of Scotland.

We all know, though, that Dr. Bell is an American as much as any Pilgrim Father ever was. Americans of his type, who could not control the accident of birth, have helped to transform a wilderness into sovereign States, and to create great industries, important cities, vast empires, and all that sort of thing. They are proud of America and America is proud of them.

In this age of achievement and efficiency it is very difficult for us to realize the significance of what we have seen and heard tonight. We are so apt to take things as a matter of course. It is only by contrast that we can get a right perspective and form true conceptions.

WHERE TELEPHONES WOULD HAVE AVERTED A GREAT BATTLE

When Cornwallis surrendered his sword to Washington, a swift ship—mark you, a *swift* ship—was dispatched to England to carry the news. It was bad news, and we all know that bad news travels fast. Yet 37 days elapsed before George III knew that he had lost some colonies and gained some cousins.

At the close of the succeeding war, that of 1812, the transportation of news was still so slow that the battle of New Orleans, the bloodiest battle of that war or the preceding war, was fought fully two weeks after the treaty of peace was signed at Ghent, and some time later the news of the conclusion of peace and of Jackson's victory reached the city of Washington about the same time.

In 1843, when the Oregon bill was under discussion in the United States Senate, leading Senators declared that we could never have any interest in a country so remote as that with which we have been conversing so easily and familiarly this evening. "Why," declared one Senator, "it would require ten months for the representative of that far-away land to come to the National Capital and get back home again. We can never have any interest in a country so remote, so difficult to reach, and so difficult to communicate with." But in the very next year there came across the wires those thrilling words, "What hath God wrought!"

The art of transmitting intelligence by electricity was born—a new era was begun. A network of wires soon spread over the land and cables were laid across the Atlantic.

Still, only places, not people, were joined together.

After a time those very practical, commonplace words, "Mr. Watson, come here; I want you," faintly came across the electric wires. That great boon—the telephone—was now given to mankind. Then there began that tremendous development and wide expansion which culminated in 1915, when the human

voice was thrown across the continent and across the seas. And tonight the strains of the "Star Spangled Banner," borne on ethereal wings, are on their way to countless havens throughout the universe.

FORECASTING THE FUTURE FORTY YEARS AGO

I hold in my hand a wonderful document. It is not a speech, only a prospectus. I should like to read it all, but there is time for only a small part of it. It is dated away back 38 years ago. A young man, then at Kensington, England, was asked to say something about the future—the *future*—of the telephone, and he prepared a most remarkable paper. I wish I had time to quote it at length, word for word, but, realizing that the hour is late, I shall give you only a small part of it, and even that not in his exact words. He says: "It is conceivable that cables of telephone wires could be laid underground or suspended overhead, connecting up by branch wires private dwellings, country houses, shops, manufacturing establishments, etc., and also connecting cities and towns and various places throughout the country." He says further: "I am aware that such ideas may appear to you Utopian and out of place, but, believing as I do that such a scheme will be the ultimate result of the introduction of the telephone to the public, I impress upon you the advisability of keeping this end in view that all present arrangements may be ultimately realized in *this grand system.*" Then he goes on with further details, and finally says: "Although there is a great field for the telephone in the immediate present, I believe there is still greater in the future. By bearing in mind the great object to be ultimately achieved, I believe that the telephone company cannot only build up a remunerative business, but also *benefit the public in a way that has never previously been attempted.*"

A document like this, if written in earlier years, dealing with subsequent events of general human interest, would have entitled its writer, when its predictions had become realities, to a place among the prophets.

This remarkable paper closes in this way:

"I am, gentlemen, your obedient servant,

"ALEXANDER GRAHAM BELL."

As the telephone art is an American art, so the telephone habit is an American habit. A few days ago I asked one of our young men to give me a few statistics. I thought that an occasion like this would not be complete without some statistics; but I asked the young man for statistics without figures, and this is what he has given me:

STATISTICS WITHOUT FIGURES

The two States of New York and Pennsylvania have as many telephones as the whole of Great Britain, France, Belgium, Italy, Serbia, and Russia combined, while Ohio and Illinois have as many as Germany, Austria-Hungary, Bulgaria, and Turkey combined.

This cautious young man puts in this note: "This alignment of States is for comparative purposes only, and is not intended to have any other significance."

The city of Chicago, with substantially the same population as Paris, has four times as many telephones as the French capital.

Boston and its suburbs, with about one-third of the population of Berlin and Vienna combined, have as many as both of these European capitals.

San Francisco, with substantially the same population, has eight times as many telephones as Edinburgh, while Washington, with only two-thirds of the population of Edinburgh, has more than three times as many telephones as the Scottish capital.

Here the young man inserts this note: "Apologies to Dr. Bell. Edinburgh still maintains its claim to the honor of being his birthplace. Let Edinburgh beware!"

New York City and its immediate suburbs have as many telephones as London, Brussels, Paris, Petrograd, Rome, Belgrade, Tokio, Berlin, Vienna, Budapest, Sofia, and Constantinople all combined.

NOTE.—"Here there is no indication of anything but the strictest neutrality. The comparison is between New York

Photograph by M. Rosenfeld

AN AFTER-THE-STORM SCENE ON A GREAT VOICE HIGHWAY NEAR YONKERS, NEW YORK

and its suburbs and all the capitals of all the warring nations, including Japan."

New York City alone, exclusive of its suburbs, has twice as many telephones as the whole of France, nearly one-half as many as the German Empire, and quite as many as the whole of Spain, Portugal, Switzerland, Italy, Greece, the Balkan States, Turkey, and Russia combined.

General note: The European statistics used are those of 1914, immediately prior to the outbreak of the war, when the figures, both as to telephones and population, were probably somewhat higher than they are today.

EXPENDITURES TWICE AS LARGE AS AT PANAMA

The statement closes with this item: The amount of money spent by the Bell Telephone System in construction work alone from 1906 to 1914—the period occupied in the construction of the Panama Canal—was more than twice as much as the amount spent by the United States government during the same period in the construction of the canal, exclusive of the amounts paid to the French Company and to the Republic of Panama.

In conclusion, I want to say for the multitude of people in this vast organiza-

tion that we have a wholesome respect for our trade. We like to think of it as a high and noble calling. We like to think that our army of men and women is doing a good work, making the world better, advancing civilization. It is a most exacting work, so exacting that at times we feel like the prisoner of Zenda, whose watchful guards never let him fall asleep, even for a moment.

Though exacting, it is fascinating—fascinating because each one of us sees the relation of his individual work to the work of every other one in the system and the essential relation of the whole to all other activities which, together with it, make up the work of the great pulsating world.

Last—and this is the end—it is satisfying. It is satisfying because through it all there is the spirit of service, than which there is nothing more inspiring and uplifting, because it is manifestly and preëminently of distinct and definite value to mankind, a factor in the advancement of civilization—breaking down the barriers of local prejudice everywhere and spreading mutual understanding, peace, and brotherhood throughout the world.

ADDRESS OF HON. JOSEPHUS DANIELS, SECRETARY OF THE NAVY

While we live in a day when there are some things yet to be righted in the world and some problems yet to solve, it is nevertheless a privilege of men of this generation that we live at a time when the dreams of poets, seers, and prophets have been translated into realities.

The finest things in the world are dreams. "Where no vision is the people perish," wrote one of the old seers, and another, whose vision seemed to overleap centuries and even millenniums and focus itself upon our own times, said: "Many shall run to and fro, and knowledge shall be increased."

It is indeed wonderful what some of those ancient wise men foresaw. Did Nahum get a foreglimpse of automobiles when he wrote: "The chariots shall rage in the streets. They shall jostle one against another in the broad ways; they shall seem like torches; they shall run like the lightnings."

PROPHECY FULFILLED

Coming down the ages to some of the later men and women of vision, did Mother Shipton foresee railroad trains, automobiles, wireless telegraphy, submarines, and flying machines when in 1481 she wrote:

"Carriages without horses shall go;
Accidents fill the world with woe.
Around the earth thoughts shall fly,
In the twinkling of an eye.
This world upside down shall be,
And gold be found at the root of a tree.
Through hills man shall ride,
And no horses be at his side.
Under water man shall walk,
Shall ride, shall sleep, shall talk.
In the air man shall be seen,
In black, in white, in green."

Did old Jeremiah get a foreglimpse of the aëroplane as an army scout when he wrote (Ch. 48: 41): "Behold he shall fly as an eagle and shall spread his wings over Moab. Kerioth is taken, and the strongholds are surprised."

But there can be no doubt as to what Tennyson was prophesying when he said:

"Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight, dropping down the costly bales;
Heard the heavens fill with shouting, and there rain'd a ghastly dew,
From the nations' airy navies grappling in the central blue."

Jules Verne a few years ago stimulated the imagination when he permitted his fancies to run riot and thrilled us with what seemed stories of the impossible in his "Twenty Thousand Leagues under the Sea." What royal fiction it was and how we reveled as he gave us eyes to see ships anchoring upon coral reefs and speeding on their missions without making a ripple upon the surface of the ocean!

New discoveries and twentieth century genius have translated Verne's dream into the most deadly instruments of destruction.

In the "Lay of the Last Minstrel," Walter Scott sang of another wizard:

"In these far climes it was my lot
To meet the wondrous Michael Scott,
A wizard of such dreaded fame
That when, in Salamanca's cave,
Him list his magic wand to wave,
The bells would ring in Notre Dame!"

Photograph from U. S. Navy Department

THE FIGHTING TOP WITH ITS WIRELESS CROWN

Truly the miracle of the twentieth century has been the discovery of radio transmission; it is the marvelous fulfillment—a fulfillment which we could not believe unless we had heard it with our own ears—of the story of Michael Scott waving his wand in Salamanca's Cave and thereby ringing the chimes in the cathedral spire.

THE SPEED OF ELECTRICITY

The human voice, projected by wireless telephony, can travel around the earth about seven times in a second. One can speak to a place half way around the earth in one-fourteenth of a second.

What a marvelous thing is the human voice! The Scripture itself declares to us that the Almighty incarnated in the forerunner of the Christ, the human Voice; so that we are told that the strange prophet of the Judean deserts, who wore camel's hair and whose food was the honeycomb and the fruit of the wild locust, was "the Voice of one crying in the wilderness."

And now what a wonderful thought it is, that the human voice, with all its power, with all its influence, with all it has meant to literature and life, has, under the power of the wizard genius of man, been made to overleap continents and oceans!

"A BEATEN TRACK TO HIS DOOR"

It is to American engineers that the world owes the perfection of wireless telephony. Pursuing his studies quietly and unknown to the world for many years, Carty has written his name on the roll of honor of science. Emerson said:

"If a man can write a better book, preach a better sermon, or make a better mouse-trap than his neighbors, though he build his house in the woods, the world will make a beaten track to his door."

While the world is indebted to the engineers and scientists for the invention, it is due a further debt of gratitude to Mr. Theodore N. Vail for its adaptation to the needs of commerce and the organization and perfection of a system for rendering it useful in this way. They built upon the work of Marconi, and Marconi built upon the work of Bell and Watson.

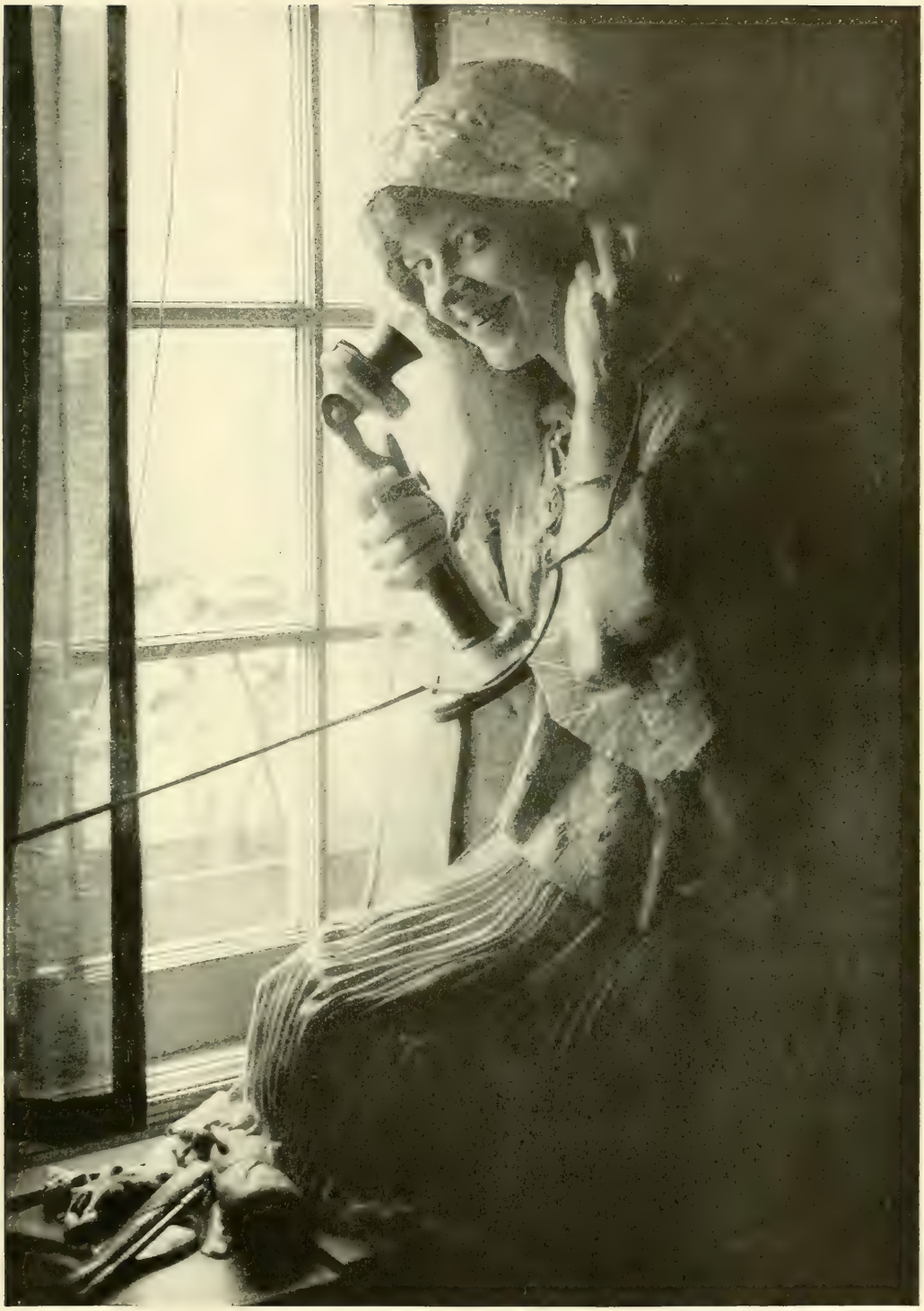
As Sherlock Holmes, the wonderful detective genius, springing from the fertile brain of Conan Doyle, had his ubiquitous and ever useful Dr. Watson, so did Alexander Graham Bell, the Sherlock Holmes of modern science, have his Watson. In capturing the marvelous secrets of nature we can hear Graham Bell give the first message ever heard over the telephone: "I want you, Watson; come here."

Only last year scientists from the old country came to Washington and, at the Naval Observatory, studied and worked with American scientists to determine the difference in latitude. Wireless messages exchanged between Paris and Washington, a distance of 3,000 miles, demonstrated the perfection reached in that wonderful field of science. It seems but yesterday that we were incredulous, as the papers brought the uncanny stories that messages could be sent from coast to coast without wires.

PERFECTING THE NAVY'S WIRELESS SYSTEM

The Navy has been a pioneer in this conquering of the waves of the air, and its high-powered stations at Arlington, San Diego, in Panama, in Honolulu, Guam, Manila, Tutuila, Alaska, etc., will shortly in very truth put a girdle around the earth, fulfilling Puck's promise "to put a girdle around the earth in forty seconds."

Working in coöperation with Mr. Carty in his remarkable achievement, was Capt. W. H. G. Bullard, U. S. N., now superintendent of the Naval Radio Service, who placed at Mr. Carty's disposal the facilities of our stations at Arlington and other places for perfecting his invention. To the Bureau of Steam Engineering of the Navy Department is due the credit of the planning and equipment of these stations in a manner which has made the radio service of the American Navy the greatest radio service in the United States or the world today. Among the officers who have been conspicuous in bringing the service to its present state of efficiency are Capt. S. S. Robison, Lieut. Commander A. J. Hepburn, and Lieut. S. C. Hooper. To the latter more than to any one else, under the direction of Rear Admiral Robert S. Griffin, is due the credit for the Navy's present system of communication. The Navy has opened 25 stations to commer-



Photograph by Paul Thompson

THE TELEPHONE GIRL

The telephone girl is no more an angel than the rest of humanity, but her patience in the face of impatience, her courtesy in the face of brusque demand, her desire to oblige in the face of ugly tempers and crusty dispositions, is wonderful. She will always "beat you to it" when you feel like smiling.

cial business, and besides that every ship of the Navy is herself a commercial station, as all private messages handled are paid for by the senders.

In addition to the paid commercial business carried on by the naval radio stations, the system renders a free service of inestimable value in the daily transmission from Arlington and other stations of the time signals from the Naval Observatory, thus enabling ships at sea, even though far beyond the range of transmission of their own equipment, to determine their exact chronometer correction. Even sailing vessels, which habitually make long voyages and which have no power with which to operate a radio station of their own, may at trifling expense be equipped to catch this signal. Our own naval ships have carried it far into the Mediterranean.

In addition to this, over 300 jewelers throughout the country are now receiving the Navy's time signal by radio, and there is little doubt but what this number will grow to 3,000.

WHEN WAR'S LIGHTNINGS FLAME THE SKY

During the war in Mexico, when all land wire and cable communication between the United States and the southern part of Mexico was interrupted, the naval vessels on the west coast afforded the only means of communication. The air has been put under contribution and is now the fleet-assigned servant of man. The S. O. S. call has reduced the terrors of the deep.

Another interesting feature of this free radio service, which should be of incalculable benefit to shipping, is found in the radio compass now under construction at the Fire Island station, near the entrance to New York harbor. This device is intended to send out radio signals of such a character that a vessel in a fog may get a close approximation of her "bearing," or compass direction, from the station. By means of observations taken 5 or 10 miles apart, it should be possible for the vessel to determine her actual position with fair accuracy. This is the first installation of this type to be made in this country; but a second installation of different type, though answering the same purpose, is undergoing tests at Cape Cod.

THE WIDE WORLD TO COME WITHIN EARSHOT

The signals sent out by the radio compass at Fire Island will necessarily be limited as to range; but the Cape Cod installation will allow of a coasting ship calling the station in the usual manner from any distance within the ship's ordinary range and receiving a definite reply as to her bearing from the station. In the case of Fire Island the ship will determine her bearing from the character of the signals continuously emitted; for Cape Cod the station determines the bearing of the ship from her calling signal and sends the information back. If these installations prove as successful as anticipated, the radio operators of ships will become an important part of the navigating force.

In the fall of last year the human voice was successfully transmitted by radio from the Naval Radio Station at Arlington clear across the continent to the station at Mare Island, Cal., 2,500 miles away; and several months later, sitting at his desk in the Navy Department, the Secretary of the Navy sent the first order ever issued by the Navy by wireless telephony to Rear Admiral Usher, commandant of the New York Navy Yard.

The radio system of the Navy has been so thoroughly and completely organized and the Navy's system of communication, under the efficient organization of the Office of Naval Operations by its present chief, Rear Admiral Benson, is now so effective that messages to every part of the world can be sent at any time of the day or night; and this division has been put under the supervision of a thoroughly trained naval officer, within 50 feet of the desk of the Secretary of the Navy, and in immediate touch with the officers and officials of every department.

NOTE TO MEMBERS

Owing to unprecedented conditions in the importation of special inks for color work, together with the very large increase in the edition of the NATIONAL GEOGRAPHIC MAGAZINE, due to its continually growing popularity, it has been necessary to postpone until the April number the thirty-two pages of four-color work, illustrating the article on "America's Playgrounds," which was announced for the March number.

VOL. XXIX, NO. 4 WASHINGTON APRIL, 1916

THE NATIONAL GEOGRAPHIC MAGAZINE

THE LAND OF THE BEST

BY GILBERT H. GROSVENOR

AUTHOR OF "YOUNG RUSSIA, THE LAND OF UNLIMITED POSSIBILITIES"

RARELY has there been afforded a more impressive illustration of the statement that it pays to advertise than is to be found in the story of the endless stream of tourists hastening to Europe during the several decades before the great war.

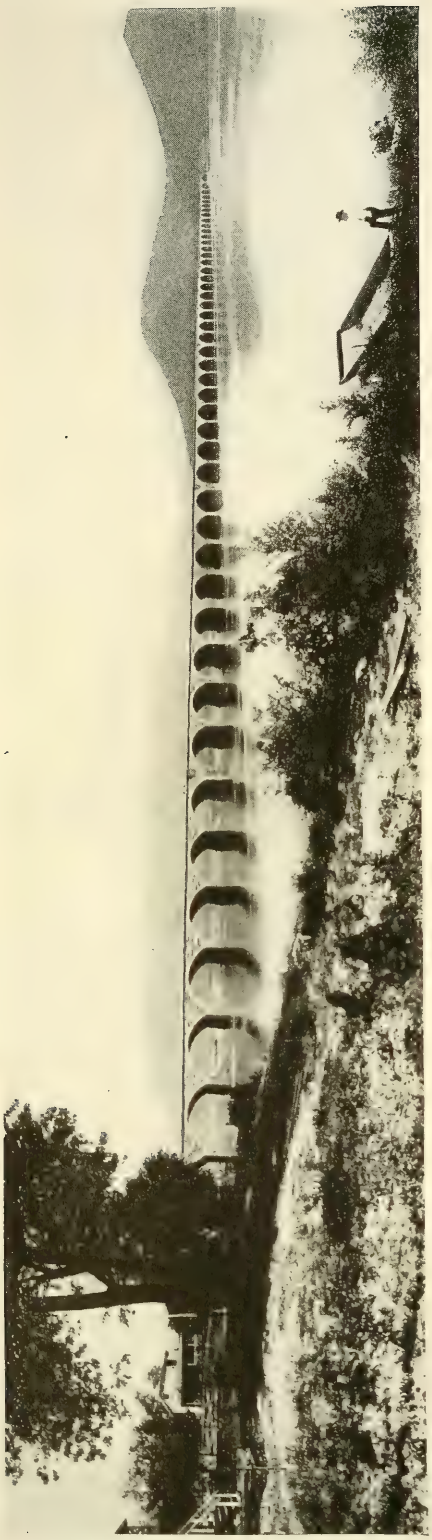
The appeal of the art treasures and associations of the Old World, which is the original home of all Americans, is really not sufficient explanation of the fact that until last year 100 American tourists were crossing the Atlantic to one American tourist who crossed the United States. The delightful literature which the European travel bureaus and steamship companies placed at our disposal so whetted our appetite for a view of the lakes of Ireland and Scotland, of the castles on the Rhine and Danube, of the scenes made famous by Shakespeare, Dickens, Victor Hugo, and Goethe, that we turned our back upon scenery more beautiful, wild flower gardens and forests incomparably finer, mountains more superb, and lakes more radiant than any to be seen in the lands across the Atlantic.

It is true that one finds a more ancient culture in Europe. It is also true that he finds more splendid architecture. And likewise it is true that he finds there better art; for before America was born into the family of nations Europe had castles and cathedrals and masterpieces of art and sculpture.

But in that architecture which is voiced in the glorious temples of the sequoia grove and in the castles of the Grand Canyon, in that art which is mirrored in American lakes, which is painted in geyser basins and frescoed upon the side walls of the mightiest canyons, there is a majesty and an appeal that the mere handiwork of man, splendid though it may be, can never rival.

Nor is our country lacking in hallowed and historic spots. Is Waterloo, where Napoleon's star of empire set forever, any more sacred to the American heart than Appomattox, where a new nation was born out of the throes of internecine strife? Are Austerlitz and Wagram, with their high tides of the French Empire, of soil more sacred, of atmosphere more hallowed than Valley Forge and Gettysburg, Plymouth Rock, Independence Hall, and Mt. Vernon? Does London or Paris or Berlin contain more of inspiration to us as a people than Washington, the Nation's Capital?

We have wandered far to find the picturesque and the magnificent, and yet it is not entirely a provincial philosophy which says that New York is in many ways the most wonderful, the most striking, and the most interesting of all the cities of the earth; neither is it only the voice of the man who has never seen other shores that pronounces Yellowstone Park the most marvelous picture-book



STONE BRIDGE OVER THE SUSQUEHANNA RIVER AT ROCKVILLE, PENNSYLVANIA

One might travel all over Europe without seeing a more picturesque landscape than this, or a more successful combination of art and nature in a single scene

of Nature's library; nor yet is it the narrow pride of the spread-eagle orator alone that awards to the Grand Canyon and the Yosemite and the Big Trees first place among the wonder scenes of the earth.

Luray Cave, in Virginia, and the Mammoth Cave, in Kentucky, surpass in originality and grandeur any caves in Europe, while Niagara Falls has no rival in Europe or in Asia, and our American forests are the glory of the world.

Man goes to Asia and to Africa to study forgotten civilizations, when the Redskins upon our own Western plains and in our own cliff dwellings reveal stories of the past as strange as any we know, and constitute a race more magnificent in physique than any that can be found in other parts of the world.

When one comes to examine the literature of America for the tourist, one is amazed at the contrast between that literature and what he finds from other countries. Baedeker publishes a guide-book in three volumes to tell about Italy, and one volume to tell about the United States and Mexico. One can find more literature about the geysers of New Zealand than about those of the Yellowstone (though the Yellowstone contains more geysers than all the rest of the world); more about the troglodytes of northern Africa and Asia Minor than about the cliff-dwellers of Arizona and New Mexico, though the latter were much more ingenious and more amazing in their achievements.

As it would require more space than there is between the covers of this Magazine merely to index all the places of scenic and historic interest in our country, in this article we must content ourselves with mentioning in text and picture only a comparatively few. Remember, that the United States, excluding Alaska, is as big as England, Scotland, Ireland, France, Germany, Spain, Portugal, Italy, Austria-Hungary, the Balkan States, Switzerland, Holland and Belgium,

Photograph by Edwin H. Lincoln

"THE BAREFOOT BOY WITH CHEEKS OF TAN"

This young man cut his "fishin' pole," dug a can of worms, gathered up his basket, and then said: "Mother, how many do you want?"

Photograph by Edwin H. Lincoln

THEIR LAST PORT: NEW BEDFORD, MASSACHUSETTS

Whalers *Rousseau* and *Desdemona Rousseau,* built in 1802 by Stephen Girard, of Philadelphia, and used at one time as packets between Liverpool and Philadelphia. The fortunes of most of New Bedford's leading families were founded on whale oil and "bone," and every tradition of the town has a whaling background.

Photograph by Edwin H. Lincoln

LOMBARDY POPLARS ON ROAD BETWEEN LENOX AND PITTSFIELD, MASSACHUSETTS

Pittsfield's Public Green has been called "the heart of the Berkshires," and Lenox has been christened "the gem of the mountains." Between them stretches miles of scenery, with old Greylock in the distance, as pastoral in its charm, as soft in its beauty, as inviting in its appeal as anything that Europe can offer.

Photograph by Edwin H. Lincoln

A NEW ENGLAND VILLAGE

Do the rural communities of England or France contain anything more graceful or picturesque than our American elms?

THE LANCASTER ELM, THE LARGEST IN MASSACHUSETTS

Several of our States already are pointing the way that all of them are certain to travel in the future. Mountain tops, historic sites, battlefields, and other places of scenic and historic interest are being acquired by the State and reserved for the public.

Norway and Sweden, and European Russia, excepting the provinces of Archangel and Perm.

PICTURESQUE AND HISTORIC NEW ENGLAND

Boston—with its rich history of Colonial days, its brave leadership of Revolutionary times, its appreciation of culture in the years when our people were so deeply absorbed in the problem of conquering the wilderness and building a nation—takes on a new meaning when one has visited its Commons, passed in and out of the portals of Faneuil Hall, made a pilgrimage to its old churches and the burying ground where lie the ashes of Hancock, Adams, and Paul Revere.

Already more than 50,000 people annually journey to the town of Plymouth to pay reverent homage to the memory of the *Mayflower*. Plymouth Rock is now appropriately cared for. On the hill near by rises a beautiful monument, which the nation has erected to the memory of those who risked their all to come to America in that pilgrim craft. It is said that the splendid statue of Faith which crowns this monument, and which is 40 feet high, is the largest stone figure in the world.

Plymouth Rock can never mean as much to the American who has not seen it as it does to him who has stood on Plymouth's sacred soil and felt the thrill of the spirit of those who fashioned here a cradle of modern liberty.

A hundred and one delightful and rest-

A NEW HAMPSHIRE HARVEST SCENE, WITH CHERRY MOUNTAIN IN THE DISTANCE

When the broad elm, sole empress of the plain, whose circling shadow speaks a century's reign,
Wreathes in the clouds her regal diadem— a forest waving on a single stem.
—Oliver Wendell Holmes.

The trees of America are the best God ever planted. Vast stretches of them have been cleared, but our forests still contain the largest, most varied, most fruitful, and most beautiful trees in the world. Wide-branched oaks and elms in endless variety, walnut and maple, chestnut and beech, sycamore and locust, along the coast of the Atlantic; to the southward, dark, level-topped cypresses, sparkling spice trees, magnolias and palms, glossy-leaved, blooming, and shining continually; to the northward, white pine and spruce, hemlock and cedar; westward, oak and elm, hickory and gum, ash, linden, laurel and pine, juniper, cactus and yucca; westward still further, new species of pine, giant cedars and spruces, silver firs and sequoias, "kings of their race."—JOHN MUIR.

ful places in Maine beckon the tourist, from the rock-bound island of Mt. Desert, on its southern shore, to the primeval forests of its northern woods.

One who visits New England without going to the top of Mt. Washington, the culminating peak of the White Mountains, misses one of the charming experiences which that part of our country, famous alike for its history and its scenery, has to offer. He who reaches the summit of that lofty peak journeys as far north in temperature and in flora as Greenland. From the Observatory one may look north, south, east, and west, the only limit to the view in any direction

JUST FROST! MOUNT WASHINGTON, NEW HAMPSHIRE, SEPTEMBER 30, 1915

A combination of an exceptionally heavy frost and a strong wind one morning last September transformed the end of the railroad trestle and the little stage office on the top of the mountain into fairy structures of glistening white.

Photographs by Guy L. Shorey

MOUNTS ADAMS AND MADISON FROM CORTES NOTCH TRAIL: NEW ENGLAND

One does not have to travel across the continent to find mountain-climbing steep and rugged enough to gratify all but the confirmed Alpinist

Photograph by Edwin H. Lincoln

THE VALLEY OF THE HOUSATONIC, WITH GREYLOCK IN THE DISTANCE: PITTSFIELD, MASSACHUSETTS

This valley has contributed the marbles out of which some of America's most noted structures have been built. The Nation's Capitol, at Washington, and the City Hall, at Philadelphia, share with St. Patrick's Cathedral, at New York, the common origin of their marbles. Old Greylock, "cloud girdled on his golden throne," is the highest mountain in Massachusetts.

being the power of the eye to penetrate the distance. Northward, one looks into Canada; eastward, into Maine; southward, across New England; westward, into New York.

It was Henry Ward Beecher who said of the autumnal foliage of the Berkshire Hills: "Have the evening clouds, suffused with sunset, dropped down to become fixed into solid forms? Have the rainbows that followed autumn storms faded into the mountains, and left their mantles there? What a mighty chorus of colors do the trees roll down the valleys, up the hillsides, and over the mountains!"

These hills constitute one of the foremost playgrounds of the eastern United States. Their roads are as good as the Appian Way ever was in the palmiest days of the Roman Empire.

And he who journeys southward from them comes down the verdant valley of the Connecticut, the central portion of that charming little State of which De Tocqueville on his visit proposed his remarkable toast: "And now for my grand sentiment: Connect-de-coot, ze leetle yellow spot zat make ze clock-peddler, ze school-master and ze Senator; ze first give you time, ze second tell you what to do wiz him, and ze third make your laws and civilization."

New Haven and Cambridge are two spots that must ever be hallowed in American history, for who can estimate the nation's debt to the two old uni-

Photograph by Edwin Levick

GRANT'S TOMB, NEW YORK CITY, SHOWING THE HUDSON WITH THE ATLANTIC FLEET RIDING AT ANCHOR

Next to Central Park, where broad acres of the most expensive land on earth present a velvety expanse of green, and great rocks, surrounded by carefully tended shrubbery and graceful trees, retain their rough natural beauty, the most inspiring "breathing space" is perhaps Riverside, which occupies a considerable proportion of the shore of the Hudson north of Seventy-second street. From this park a fine view of the Hudson River may be had, and within its confines is located the stately tomb of General U. S. Grant, which is to New York what the tomb of Napoleon is to Paris.

Photograph by Brown Brothers

THE TOP OF THE BUSINESS WORLD: LOOKING FROM THE WOOLWORTH BUILDING PAST THE BATTERY TOWARD THE SEA

It takes no undue amount of national pride to accept New York as the world's foremost metropolis. London may be hundreds of years older and bigger; Paris may surpass it in art and architecture; Berlin may hold the better of the argument in "newness," but nowhere else on the face of the earth is there a city of such many-sided greatness as New York. Its port does more business, its banks have heavier clearings, its immigrant station has more incomers, its streets are trod by a more polyglot population, its urban railroads handle more traffic, its bridges carry more people, than any other city of Christendom.

Photograph by Brown Brothers

AN OASIS OF RELIGION AMID A DESERT OF BUSINESS

Trinity Church, New York, standing at the head of Wall street, its tower, looking down on America's financial center, seems a hand raised to heaven in an appeal that men may not, while absorbed in the struggle of the "Street," forget their God.

Copyright by Edwin Levick

LOOKING DOWN UPON A FOREST OF SKYSCRAPERS: NEW YORK CITY

Upon the top of one of these man-made mountains there is the same peaceful quiet as on any mountain top. No sound from the streets below comes up this distance. Men on the sidewalks are infinitesimal dots, darting hither and yon. Looking down upon them, one is inclined to reflect what puny beings humans are, and from this lofty point of view almost forgets his sympathy for their personal interests. Then comes the realization that this mountain was built by these puny beings from materials dug out of the earth in a crude state, purified, shaped, and fastened together in a manner that will make it stand practically for all time, and then a feeling of reverence for the human brain—that God-given boon which has made these things possible. Note the men on the tower in the foreground.

Photograph by Edwin Levick

WHERE ELSE IN THE WORLD DO CITY BLOCKS APPEAR SO SHORT AND BRIDGES SO LONG?

Five enormous steel bridges span the East River. Their combined cost was half as much as the Panama Canal. Three of them are suspended from cables the wires of which, if placed end to end, would more than twice girdle the earth. If placed side by side, these five great structures would provide a roadway as wide as the Washington Monument is high, and if placed end to end they would make a great bridge over six miles long. Over the Brooklyn Bridge alone 125,000 surface cars travel every twenty-four hours, with other vehicular traffic in proportion. The new Hell Gate Arch Bridge, to be opened about January, 1917, will carry four tracks of the New York Connecting Railroad, facilitating the service of at least two great lines.

Copyright by Edwin Levick

IF PETER MINUIT COULD SEE THIS, WHAT WOULD HE SAY?

Peter Minuit, the first Dutch governor, who is said to have bought Manhattan Island from the Indians in 1626 for about twenty-five dollars in red cloth and beads, would now be able to sell it in city lots for something like $3,000,000,000. Peter probably bought more wisely than he knew, however, for it is not likely that he dreamed of office buildings half a hundred stories high, and never investigated the foundation possibilities of the island, the solid rock of which makes it possible to build the city so far up into the sky.

Photograph by Edwin Levick

"AW COME ON IN—THE WATER'S FINE"

New York policemen develop bad eyesight in the vicinity of park fountains on hot days, and those young Americans who play such an important part in the publishing business, distributing hundreds of thousands of newspapers, realize the visual deficiencies of these guardians of law and order. The bluecoat saunters off to the farthest corner of his beat and the boys jump into the fountain.

Photograph by J. B. Allison

THE PALISADES OF THE HUDSON, NEAR ALPINE, NEW JERSEY

One cannot too heartily commend the spirit that citizen and State alike displayed in the preservation of the Palisades along the New York-New Jersey shore of the Hudson River. It seemed that the trap-rock quarryman was going to forever ruin their beauty, and that the continued acquisition of lands along the Hudson for private purposes was destined to deny to the public at large free access to the shores of the American Rhine. But in 1900 New Jersey and New York took joint action for the acquisition and dedication to the public of 10,000 acres along the banks of the river and the creation there of an interstate park. Ten years later Mrs. Edward H. Harriman and many other public-spirited people joined hands with the two States and acquired 10,000 acres more.

NIAGARA FALLS, CIVILIZATION'S SUPREME SPECTACLE IN WATER

THE AMERICAN FALLS: NIAGARA

Photograph by E. W. Fox

IN THE GRIP OF THE ICE KING: NIAGARA FALLS

Though Niagara is awe-inspiring and soul-conquering in its thundering power, the silent, noiseless, eerie army of the Ice King sometimes steals upon it, stills its thunders, and transforms its plunging waters into solid masses of ice.

Photograph by Charles R. Martin

THE WASHINGTON MONUMENT, LOOKING ACROSS TIDAL BASIN FROM THE POTOMAC

Expositions come and expositions go, but there is one great exposition that is always in season, perennial in its beauty, enduring in its interest, and rich in its exhibits; the nation's capital is an "always open" exposition of American history and American achievement. Weeks can be spent profitably within the shadow of the Washington Monument, visiting the great exposition halls which have not been built for a month or a year, but to endure for time to come.

Photograph by Charles R. Martin

THE CAPITOL AT WASHINGTON AFTER A SNOW-STORM

Underneath this imposing dome the laws of the nation are enacted by Congress, having now a membership of between five and six hundred representatives from the forty-eight States. Under it also sits the United States Supreme Court—the Federal tribunal of last resort. It represents the beginning and the end of law. Every tourist ticket should read via the nation's capital.

Photograph by Eugene J. Hall

THE TOWN OF JOHN BROWN'S RAID: HARPERS FERRY, WEST VIRGINIA

Where the Shenandoah, called by those who live in its famous valley "fair daughter of the skies," joins the Potomac at Harpers Ferry they make a picture of seldom-exceeded natural beauty. Jefferson called the gorge through which the Potomac passes the Blue Ridge Mountains "one of the most stupendous scenes in nature." Of course, if he had seen the Grand Canyon, the Yellowstone National Park, Yosemite, or the Royal Gorge, he would not have put it so strongly; but Harpers Ferry none the less is a bit of scenery which a whole nation may well treasure.

Photograph by George F. Adams

A VIEW OF FORT MONROE AND OLD POINT COMFORT, VIRGINIA

In no territory of like extent in the United States is more historical interest gathered than in that which borders Hampton Roads. Here was planted the first English colony in America; here was held the first gathering of the people's representatives to make their own laws; here were erected the first fortifications in the English-speaking New World; here was fought the land battle that terminated America's War of Independence and the naval battle that revolutionized the warfare of the sea. The first fortifications where Fort Monroe now stands were built 305 years ago, in 1611. Since that time, with short lapses, there has been some sort of a fortification always guarding the entrance to Chesapeake Bay. Rich in history, balmy in climate, charming in prospect, the Old Point region has entertained its hundreds of thousands with Virginia hospitality.

THE MAIN STREET OF YORKTOWN, VIRGINIA, WHERE CORNWALLIS SURRENDERED TO WASHINGTON IN 1781, NEAR THE MOUTH OF THE YORK RIVER, 33 MILES FROM NORFOLK

The house on the left was the first custom-house in America. The ox-cart is still more in evidence than the automobile. Here stands the house of General Nelson, the Virginia patriot, who offered twenty guineas to the first cannoneer who would hit his house, saying that it meant nothing to him while it harbored the enemy of his country—Cornwallis. And a cannon-ball embedded in the chimney tells a story of good gunnery.

versities which honor the names of their founders, Elihu Yale and John Harvard? Surely Oxford and Cambridge have rendered no more conspicuous service to Europe than Harvard and Yale to America!

And there are many other college communities whose halls are fragrant with traditions more inspiring to Americans than any of the memories associated with the university buildings which tourists visit in Europe — William and Mary, where Jefferson and Monroe were college boys; the University of Virginia, founded by Jefferson; Princeton, the university which graduated Madison and where Joseph Henry taught.

THE EMPIRE STATE

From its metropolis in the southeast to Niagara on the west, from Plattsburg on historic Lake Champlain to picturesque Lake Chautauqua, the Empire State is full of lure for the traveler. New York City is the most cosmopolitan community of the earth. There are more Jews in it than in Jerusalem, more Italians than in Messina, more Germans than in Bremen, and more Slavs than in Kishinef.

Some one has said that New York is a city that is all things to all men; that the artist translates it in terms of beauty, the practical man in terms of efficiency. He adds that everywhere it is spectacular, the big setting of a big drama, a place of endless experiment and achievement, the city of skyscrapers, whose elevators convey one with the speed of an eagle to dizzy summits, from which those who walk the narrow street below seem like so many ants following their daily toil.

To the Hudson River many a world traveler has paid tribute. George Wil-

Photograph by H. C. Mann

BRUTON PARISH CHURCH: WILLIAMSBURG, VIRGINIA

Bruton Parish Church was built in 1710 and is the oldest church in continuous use in the United States. It was more intimately associated with colonial history than any other building in Virginia. Five Presidents of the United States—Washington, Jefferson, Madison, Monroe, and Tyler—worshipped here, as did also all of the colonial governors and the members of the House of Burgesses for three-quarters of a century. Among its interesting relics are the Jamestown baptismal font and communion service.

liam Curtis declared that "the Danube has in part glimpses of such grandeur, the Elbe sometimes has such delicately penciled effects, but no European river is so lordly in its bearing, none flows in such state to the sea. Of all our rivers that I know, the Hudson, with its grandeur, has the most exquisite episodes; its morning and evening reaches are like the lakes of a dream."

The trip from New York up the Hudson is one of rare delight, whatever the season, for between the magnificent country estates and the history and legends of Tarrytown and Sleepy Hollow, of West Point and the Catskills, there is romance and entertainment in every mile. But when autumn comes, and the trees reach their unanimous verdict that the colors of the rainbow should be matched by the colors of their foliage, the traveler upon its waters might well "doubt if Eden were more fair."

The Adirondack region, stretching from Canada down almost to the Mohawk Valley and from Lake Champlain to the St. Lawrence River, will ever claim the loyal admiration of the tens of thousands who visit it. The beauty of its intricate chain of lakes, the solitudes of its deep wilderness, and the magic of its flaming chasms linger in the minds of all who have wandered there.

Upon the southeastern border of these mountains lies Lake George, a gem in a setting of mountains. The Italian thinks

Photograph from M. L. Alexander

THE WASHINGTON OAK, THE LARGEST LIVE-OAK IN THE WORLD: AUDUBON PARK, NEW ORLEANS, LOUISIANA

The gnarled, wide-branched oaks and the funereal Spanish moss are not confined to Louisiana's vast virgin forests. They come right down into the city, and one who rides through Audubon Park and feels its restful spell cannot but accept, at least in part, New Orleans' proud boast that she is the "city that care forgot."

of it as Como, the Englishman as Windermere, and the Scot as Katrine, for it possesses much of the enchantment of each of these famous waters.

In central New York are to be found those remarkable lakes which we know as Oneida, Cayuga, and Seneca.

The culminating spectacle of the East, by unanimous consent, is Niagara Falls. The Indians described it in a phrase than which no word-painter has ever found one more expressive. They called it the "Thunder of Water." Niagara is without a setting. Some scenes gather as much from their surroundings as they themselves possess; like a mirror, they borrow some of the loveliness we behold in them from other sources. But Niagara has all its beauty and sublimity within itself. There is nothing of charm or attraction in the approach to it from whatever direction.

Just as the United States is setting aside national parks and national monuments in the West for the benefit of the generations that shall come after us, so New York, in particular, is making reservations, historic and scenic, for the benefit of her people.

The American Scenic and Historic Preservation Society is incorporated under the laws of that State and has been intrusted with the custody of most of these places. It annually makes a report to the Governor, showing what steps are taken, and has labored with unusual success in its field. Letchworth Park and Fort Ticonderoga, the one an example of

Photograph by Hypo Coquille

UNCLE EPH'M AND HIS OLD GRAY MULE IN FROM THE COUNTRY: BAYOU SARA, LOUISIANA

This is a surviving touch of the old South, of the days of "My Old Kentucky Home," "Suwanee River," and "Old Black Joe"

the places of natural beauty and the other of the places of historic associations, are under its control.

INDEPENDENCE HALL AND VALLEY FORGE

The State of Pennsylvania has her share of shrines. In Philadelphia there is Independence Hall, than which there is no more hallowed edifice in Europe or America, for it was in this old brick building that democracy had its birth. Surely no place in Europe holds as just an appeal to the lover of liberty.

And then there is Valley Forge, set aside by the State of Pennsylvania as a park. How can Americans better comprehend the sufferings and sacrifices out of which our nation was born than to go to Valley Forge, and there on the very ground read the story of that cruel winter which moved the Father of His Country to tears!

Within a few hours from Philadelphia, Baltimore, or Washington is the battlefield of Gettysburg, listed by the historian Creasy as one of the fifteen decisive battles of all time. As you make your pilgrimage to the sacred field through Mary-

CHATTANOOGA AND THE MOCCASIN BEND OF THE TENNESSEE RIVER FROM LOOKOUT MOUNTAIN

Eastern Tennessee and western North Carolina have some of the most beautiful landscapes in America. History and nature conspire to lend the whole region a deep and abiding interest. The picturesqueness of the Lake Toxaway country of North Carolina and the Civil War history of the Lookout Mountain country have a wide appeal and make friends of all who journey that way.

Photograph by T. P. Robinson

THIS IS NOT A SCENE ON THE BANKS OF THE NILE, BUT A VIEW ON ECONLOCATCHEE CREEK, FLORIDA

Florida, with its cabbage palms, tropical jungles, palatial hotels, and wide, hard beaches—"the land of eternal summer"—is only thirty-five hours distant from New York and thirty-three from Chicago.

A GREAT AMERICAN SILK MILL AT SCRANTON, PENNSYLVANIA

Although Paterson, New Jersey, is America's leading silk city, to the vicinity of Scranton, Pennsylvania, comes one-third of all the raw silk imported into the United States, and some of the country's biggest silk mills are located here. The illustration above shows the interior of one of these great manufactories and a typical modern American textile mill, where a maximum of cleanliness, pure air, and floods of sunlight make for the best working conditions. This enormous room has a floor area of about 35,000 square feet, and 450 operatives are required to attend to the wants of this acre of machinery.

A VIEW OF THE ALLEGHENY AT PITTSBURGH

No, this is not gravel from the river bottom nor oysters from the bay. It's a Pittsburgh coal fleet in the Allegheny River loaded with "black diamonds" to keep alight the fires which help to make Pittsburgh one of the foremost industrial cities of the world—a furnace of Vulcan in real life.

Photograph by Gilbert H. Grosvenor

ONE OF THE COUNTLESS AMAZING SIGHTS TO BE SEEN ON THE WHARVES OF OUR GREAT LAKES: FIVE HUNDRED THOUSAND DOLLARS' WORTH OF COPPER INGOTS AWAITING SHIPMENT AT HOUGHTON, MICHIGAN

Industrially as well as scenically the United States affords fields of interest to the tourist surpassed by no other part of the world. We produce three-fifths of the world's copper, two-fifths of its iron and coal, one-third of its silver, lead, and zinc, and one-fifth of its gold.

land or Pennsylvania, you see a landscape that painters love—undulating hills, rolling fields, watered with winding streams and ornamented by groves of oak and hickory, picturesque farm-houses, and huge barns packed to the rafters with Nature's gifts, for these counties possess some of the best land and best farmers of America.

Fifty-four thousand of as brave men as ever marched to martial music mingled their blood at Gettysburg in 1863. The government of the United States has spared no effort to preserve to the future the memories of those who bore the brunt of the bitter struggle, and to mark alike the position of the Blue and the Gray of those sanguinary days. It is the best marked and best cared-for battlefield in the world. With its magnificent picture of pastoral beauty, its splendid roadways, and its eloquent monuments, Gettysburg is a sight to thrill the heart of every American.

Nowhere can we find sights and memories more precious to our hearts than those which abound in Washington, the most stately capital city in the world. The glories of the nation's capital have, however, been so well described in the pages of this Magazine by ex-President Taft and Viscount Bryce that they need not be referred to here.

Not far from Washington is Harpers Ferry, where the Potomac breaks through the mountains on its way to the sea, and the scene of John Brown's raid; here came Stonewall Jackson to capture the

Photograph by W. H. Brandel

TYPES OF AMERICAN GRAIN ELEVATORS: THE GREAT LAKES

The United States is the principal grain exporting nation in the world, having more grain elevators than the remainder of North and South America and Asia and Africa together

force which stood in the way of the Confederate effort to carry the war into Maryland and the North in 1862.

From Harpers Ferry far away to the south stretches the famous Shenandoah Valley, the granary of the Confederacy in the 60's, of which Sheridan declared that he had laid it so bare that a crow flying across it would have to carry his rations. The Valley Turnpike, once the race-course of armies, is now the peaceful highway of the automobilists who journey from the North to the South.

WALLS OF DIAMONDS AND PEARLS

Half way up the Shenandoah Valley are the Luray Caverns, an underworld palace built by the busy hands of trickling waters. Aladdin, we are told, was once permitted to enter a cave which exhibited such decorations that its glory both dazzled and affrighted. But Aladdin never beheld anything more wondrously exquisite than the water-built architecture of Luray.

The Throne Room is canopied with curtains woven of diamonds and pearls. The Saracen's Tent has more than Oriental splendors of richest damasks and golden samite, which drape the crystal couch in festoons of magic beauty. Titania's Veil is woven of petrified spiders' webs, while the Ball-room seems as if set to celebrate a marriage between the gods.

The visitor to Luray today shares the sentiment of another visitor of long ago, who exclaimed: "Mortal hath not made the like, nor human fancy conceived a thing more magnificent!"

As one journeys westward from the Atlantic seaboard, whether by the northern route and by boat through the Great Lakes, touching at points of interest along their shores, or by one of the central routes through western Pennsylvania or West Virginia, or yet by a southern road through New Orleans, there will be discovered a continual succession of dramatic and matchless spectacles.

Not the least of these is the Mammoth Cave of Kentucky, the biggest cavern of the world. The discovery of the cave

Photograph by Eugene J. Hall

THE ROAD DOWN THE BLUFF NEAR ALMA, WISCONSIN: MISSISSIPPI RIVER

The country at the head of the "Father of Waters" was once the scene of hard-fought Indian wars and in those days, not so long ago, a wilderness of vast expanse. Now it is thickly settled by farmers, whose fields of golden wheat have brought them wealth, and many of whom now superintend the work on their farms from the rear seat of an automobile.

Photograph from M. L. Alexander

COFFEE EN ROUTE TO YOUR CUP: PORT OF NEW ORLEANS

New Orleans has the largest agricultural warehouse in the world. It has a capacity of 2,000,000 bales of cotton and is adapted to the storage of all other packed commodities, such as sugar and coffee. It was built at a cost of $3,500,000 by the State of Louisiana and is said to reduce the cost of handling any agricultural commodity 40 per cent. There are 23 acres of ground under roof, while the entire plant occupies 150 acres. It is only through such giant structures as these that the United States is able to handle the vast amount of agricultural commodities that pass out of our ports.

Photograph by A. Schlechten

THREE FORKS OF THE MISSOURI RIVER NEAR THE CITY OF THREE FORKS, MONTANA

Far up in the Rocky Mountains of Montana, at the eastern apex of an equilateral triangle between Helena, Butte, and Three Forks, three mountain rivers come together to make the Missouri. They are the Jefferson, the Gallatin, and the Madison, named by Lewis and Clark in honor of President Jefferson and his two ranking advisers. It was here that Sacajawea, the Indian "bird woman," guided the Lewis and Clark expedition from the Dakotas' grasp and climbed to the top of the ridge for a survey of the country. Although carried away in her childhood, she recognized the spot as her long-ago home, and announced that she knew the territory from there to the Pacific. In the picture the river on the right is the Jefferson, that in the center the Madison, and that to the left the Gallatin.

NEARING THE SUMMIT OF PIKES PEAK ON THE COG RAILWAY

Pikes Peak, 14,108 feet, is the highest mountain in America whose summit is reached by a railroad. Little Switzerland, only one third as large as the State of New York, contains more mountain tops accessible by railway than the entire United States. It may be stated, however, without belittling the enterprise and industry with which the Swiss engineers have patiently constructed their marvelous railways to the summits of Gorner Grat, Pilatus, Brienz, Rigi, etc., that the money which financed these railways was in large part the vacation cash left in Switzerland by American tourists.

was a God-send to the country, for in the war with England in 1812 the United States secured from it the nitrous earth from which was derived the saltpetre used in the manufacture of the gunpowder for our armies.

Nowhere else can one travel so far in Plutonian regions of perpetual night, where petrified efflorescence is a substitute for vegetation, as in this great cavern. Vastly larger than Luray, the Mammoth Cave possesses a rich variety of formations. Many of these are huge in their proportions and remarkable in the delicacy of their structure.

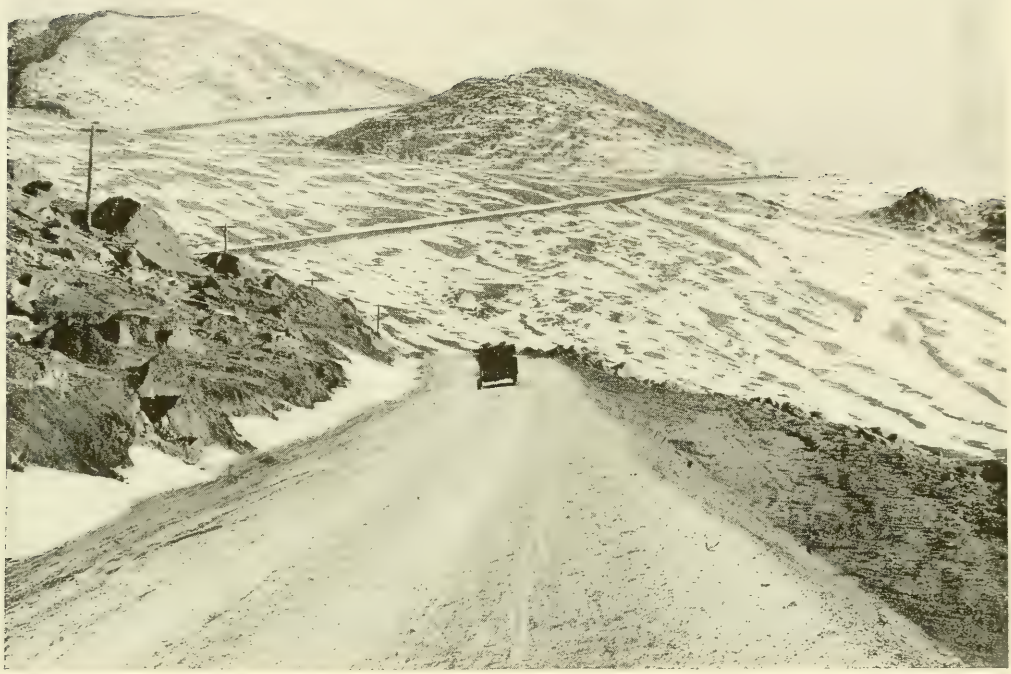
Strange species of creatures are to be found there. One of these is a blind and wingless grasshopper, with extremely long antennæ; another is a blind and colorless crayfish; and a third, a blind fish which grows to the length of about six inches, and possesses the additional curiosity of being viviparous, producing its young in a living state instead of by eggs. Occasionally there are fish caught in the running streams of the cave which are identical with species common in Green River, indicating a subterranean connection between that river and the streams of the cave.

THE MOST IMPORTANT RIVER IN THE WORLD

The imperial Mississippi Valley may well claim the attention of those who

PIKES PEAK AUTO HIGHWAY, SHOWING A HAIRPIN CURVE FIFTY FEET WIDE

Few States have done as much as Colorado to make their scenery accessible to the tourist. The building of the splendid automobile highway to the top of Pikes Peak exemplifies what a progressive spirit the Centennial State has shown, both in providing visitors with facilities for seeing her places of interest and in welcoming them to her borders.



ON THE ROAD TO THE SUMMIT OF PIKES PEAK

The automobile in the picture is 13,000 feet above sea-level. On the top of the peak there are long-distance telephones, a parking space for three hundred automobiles, and a lake.

would know and appreciate the bigness and the diversity of industry and power of our country.

Our books tell us that 22 of our States and 40 per cent of the total area of our country are comprised within the Mississippi Valley; that nowhere else on the globe is there as large a region of equal fertility; that it grows the bulk of the nation's food and produces nearly two-thirds of our manufactures, and that, politically and commercially, it is more important than any other valley in the world.

But how tame the written statement is compared to the actual sight of oceans of green, growing corn; of waving wheat, oats, rye, and barley extending for hundreds of miles; of the huge plows, reapers, and threshing machines drawn by 16 horses or propelled by engines as big as the locomotive of an express train.

Or, if you are more interested in seeing things fashioned by the brain of man, tarry at Gary, Dayton, Cleveland, Detroit, Chicago, Milwaukee, etc., each the birthplace and home of enterprises peculiarly American and giving employment to tens of thousands. There you will stand in awe at sights a thousand times more astounding and stimulating than many of the feudal castles and tortuous streets of Baedeker's specialties.

The fortunate individual who can follow our majestic Father of Waters from the upper reaches of its principal tributary, the Missouri, down the longest river course in the world to the Gulf of Mexico will have an experience that cannot be duplicated. As he successively watches

Photograph by George L. Beam

THE ROYAL GORGE, GRAND CANYON OF THE ARKANSAS: COLORADO

This gorge is the deepest chasm in the world through which a railroad passes. At one point it is so narrow that the railroad, unable to find a road-bed, passes over an iron bridge 200 feet long, suspended from girders mortised into the granite walls of the gorge, which is here half a mile deep.

Photograph by Hiscock

VIEW IN SHOSHONE CANYON: WYOMING

The automobile road from Cody, Wyoming, to the Yellowstone Park, which the United States Government has constructed, passes through the Shoshone Canyon. Five tunnels had to be blasted for its passage. Here the Government has built the second highest dam in the world. The lake it forms has a shoreline 42 miles long and furnishes water for the irrigation of more than 40,000 acres of land.

Photograph by F. J. Haynes

LONE STAR GEYSER: YELLOWSTONE NATIONAL PARK

There are more geysers in Yellowstone National Park than in all of the remainder of the world. Stupendous as are the spectacles of these giant natural fountains in eruption, they are but feeble reminders of the titanic times whose records are written all over the face of the park.

Photograph by F. J. Haynes

THE GIANT GEYSER OF THE YELLOWSTONE NATIONAL PARK

The Giant Geyser, with its tremendous outpouring of water and steam shooting 200 feet into the air and lasting for a full hour, is one of dozens of geysers found in the Yellowstone. They have all been named, and expressively so: the Black Growler, always fretting and fuming, but never doing much else; the Constant, on the job every half minute, with a ten-second eruption; the Minute Man, with a one-minute eruption and an irregular, short interval; the Beehive, shooting up out of a hivelike sinter cone; the Castle, with its fairy house; the Comet, the Daisy, the Economic, the Fan, and the Lion, each filling well the plans and specifications of its name; and Old Faithful, the originator of the "every hour on the hour" schedule.

Photograph by Edward S. Curtis

A HERD OF BISON IN THE YELLOWSTONE NATIONAL PARK

Yellowstone National Park is destined to be the principal game preserve in America. It contains an increasing herd of wild bison, fifteen thousand elk, several thousand moose, and innumerable deer. It is not an exceptional sight to see a park attendant feeding lump sugar to little bear cubs, while the mother bear plays the rôle of interested spectator in the offing. More than one hundred and fifty species of wild birds lead an undisturbed existence in the park.

Photograph by W. S. Berry

YELLOWSTONE FALLS: YELLOWSTONE NATIONAL PARK

Yellowstone Canyon has been called the cameo of canyons. Burton Holmes has described it as "a mine of precious stones, uncovered to amaze and dazzle the sun itself." Adown its rocky bottom flows the Yellowstone River, and, where it is grandest and most beautiful, the river takes a leap twice as high as Niagara, making a marvelous veil of seething, frenzy-lashed, white water—a spectacle which, with its setting and majestic roar, is one of awe-inspiring majesty.

Photograph by F. J. Haynes

EAGLE-NEST ROCK: YELLOWSTONE NATIONAL PARK

It seems as if Nature decided to establish in the region which we call the Yellowstone National Park a museum where, without traveling far, mankind could study all of her processes and see exhibits portraying all of the activities of the millions of years of earth-making.

Photograph by Roland W. Reed

THE OBELISK: CAÑON DE CHELLY, ARIZONA

The tiny men on horseback at the foot of this towering shaft of stone tell a striking story of its size. It is but one of a thousand of these stately spires and nature-built obelisks that rise out of the earth in this region of scenic surprises.

THE RAINBOW NATURAL BRIDGE: UTAH

Photograph by Kolb Bros.

The biggest natural bridges in the world are to be found in the United States. The largest of these, the Rainbow, 308 feet high, would span the dome of the United States Capitol, with room to spare, and is nearly as high as the Flatiron Building in New York. Its span is six times as great as that of the Natural Bridge of Virginia. Utah alone has three natural bridges that are higher and of greater span than any other natural bridge in the world.

Photograph by N. H. Darton

A VIEW OF ONE OF THE SIDE WALLS OF THE GRAND CANYON OF THE COLORADO

"Looking down more than half a mile into this 15 by 218 mile paint-pot, I continually ask, Is there any other fifty miles of Mother Earth that I have known as fearful, as full of glory, as full of God?"—JOAQUIN MILLER. "A pageant of ghastly desolation and yet of frightful vitality, such as neither Dante nor Milton in their most sublime conceptions ever approached."—WILLIAM WINTER. Search the entire globe and you will find nothing outside the United States comparable to the Grand Canyon.

250 other rivers, many of them turbulent giants like the Ohio, the Arkansas, the Red, etc., add their brown floods to the broad torrent, he can easily comprehend the statement that the Mississippi River discharges into the sea one-half more water than do the Rhine, Loire, Po, Elbe, Vistula, Danube, Don, Dnieper, and Volga all together, and that it brings down to the Gulf of Mexico annually more material than has been taken out of the Panama Canal from the day that De Lesseps removed the first shovelful of earth.

On the lower reaches of the Mississippi he sees dikes thicker, higher, and longer than any Holland can show, parts of a levee system much more extensive than the famous reclamation works on the Zuyder Zee. The latter, however, are better known, being generations older and nearer to routes frequented by travelers and writers.

Here, also, he passes sugar-cane plantations, cotton fields, cypress forests, quaint old steamboats redolent with memories of the days of Huck Finn, picturesque negro populations—a weird contrast to the blazing furnaces of Pittsburgh, the white flour mills of Minneapolis and St. Paul, the noisy cattle yards of Kansas City and Omaha, the snow-capped mountains of Montana and Wyoming and Pikes Peak in Colorado, all tributary to the same river.

It is to be regretted that today there is very little traffic on the river compared to earlier days.

THE YELLOWSTONE PARK

Leaving the masterful Mississippi Valley and journeying westward, we soon enter the region of the national parks, of which there are eight of the first order—the Yellowstone National Park, principally in Wyoming; the Glacier National Park, in Montana; the Rocky Mountain and Mesa Verde National Parks, in Colorado; the Crater Lake National Park, in Oregon; the Mount Rainier National Park, in Washington, and the Yosemite and Sequoia National Parks, in California. To these must be added the Grand Canyon of the Colorado, in Arizona, the scenic masterpiece of the world, officially classed as a national monument until Congress makes it a park. Each park has its own individuality, and each in its specialty excels. Together they contain more features of conspicuous grandeur than are accessible in all the continents.

Foremost in interest in the Yellowstone are the geysers, of which "Old Faithful" ranks first, not because of size, for the Giant is a Goliath beside it; not because of beauty, for there are others more beautiful; but because of fidelity. It never disappoints. It is so regular that it could almost serve as the nation's standard timepiece. Every 70 minutes "Old Faithful" shoots its great column of water heavenward. At each eruption it sends up into the air a million and a half gallons of water (see pp. 370-371).

One writer has described the geyser basins "as laboratories and kitchens, in which, amid a thousand retorts and pots, we may see Nature at work as chemist or cook, cunningly compounding an infinite variety of mineral messes; cooking whole mountains; boiling and steaming flinty rocks to smooth paste and mush—yellow, brown, red, pink, lavender, gray, and creamy white—making the most beautiful mud in the world, and distilling the most ethereal essences.

"Many of these pots and caldrons have been boiling thousands of years. Pots of sulphurous mush, stringy and lumpy, and pots of broth as black as ink are tossed and stirred with constant care; and thin transparent essences, too pure and fine to be called water, are kept simmering gently in beautiful sinter cups and bowls that grow ever more beautiful the longer they are used.

"In some of the spring basins the waters, though still warm, are perfectly calm and shine blandly amid a sod of overleaning grass and flowers, as if they were thoroughly cooked at last and set aside to settle and cool. Others are wildly boiling over, as if running to waste, thousands of tons of the precious liquids being thrown into the air to fall in scalding floods on the clean coral floor of the establishment, keeping onlookers at a distance.

"Every flask, retort, hot spring, and geyser has something special in it, no two

Autochrome by Franklin Price Knott

A PUEBLO WOMAN AT LAGUNA, NEW MEXICO

She is shovelling bread into an open-air oven, preparing for a corn dance celebration to take place the following day. The Navajo and Pueblo Indians for a hundred miles around Laguna were met on the way to take part in the dance, which is in reality a prayer for rain.

Autochrome by Franklin Price Knott

THE SLEEPING TIGER IN THE ZOOLOGICAL GARDENS OF NEW YORK CITY

Autochrome by Franklin Price Knott

THE FAMOUS OLD MISSION OF SANTA BARBARA, CALIFORNIA

Although not a foot of soil is left to Spain in the New World, her blood, her architecture and her language remain in nearly all that vast region from Southern California to Patagonia.

Autochrome by Franklin Price Knott

A STRIKING POSE IN THE EAST INDIAN DANCE,
"THE GARDEN OF KAMA"

Autochrome by Franklin Price Knott

THE POETRY OF MOTION AND THE CHARM OF COLOR

Autochrome by Franklin Price Knott

WHAT IS RARER THAN A FROSTY MORNING WITH ITS TANG OF COLD
AND ITS RIOT OF COLOR: NEW ENGLAND

Autochrome by Franklin Price Knott

ANOTHER KIND OF PALE HORSE AND HIS RIDER

This picture of a Hopi Indian and his white burro was taken at the edge of the high mesa on which is the village of Walapai, Arizona.

SURPRISING THE ENEMY

Autochromes by Franklin Price Knott

"WILD ROSE" AND HER PALE-FACE FRIEND,
GLACIER NATIONAL PARK

Autochrome by Franklin Price Knott

A FAST–DISAPPEARING TYPE

As the settler encroaches further and further upon the cattle country, the cowboy and the romance of his calling are rapidly approaching the point where they will exist only on the motion-picture screen and in the Wild West Show.

Autochrome by Franklin Price Knott

SUNRISE SETTING THE MORNING HEAVENS ON FIRE

A poem in colors on the California Coast.

Photograph by Kiser

MT. HOOD AS SEEN FROM NEAR PORTLAND, OREGON
Truly the great Far West is a land where every prospect pleases.

Photograph by Kiser

ON THE RIM TRAIL OF CRATER LAKE, OREGON

"The eye beholds twenty miles of unbroken cliffs ranging from five hundred to nearly two thousand feet in height, encircling a deep sheet of placid water in which the mirrored walls vie with the originals in brilliancy and greatly enhance the depth of the prospect. Although the blue of the lake is deeper than anyone who has not beheld it can imagine, it is yet so transparent that even on a hazy day a white dinner plate ten inches in diameter may be seen at a depth of nearly one hundred feet."

Photograph by Pillsbury

A MEADOW IN THE YOSEMITE VALLEY, CALIFORNIA

Autochrome by Franklin Price Knott

THE CHIEF PRIEST OF THE SNAKE CLAN: HOPI TRIBE

His face and body are smeared with black and white and yellow paint. His ornaments are many. A gray fox skin dangles from his back. On his legs are bound shells of the desert terrapin with points of antelope hoofs inside to serve as rattles. Eagle feathers are carried in one hand, with which the snakes are stroked and pacified. A prayer stick is also in his hand. Some claim that the priests drink an herb tea before the dance which renders them immune to the poison, but all agree that the snakes' fangs are not extracted.

Autochrome by Franklin Price Knott

"LA MOUSE," A VENERABLE FLATHEAD CHIEF, OVER EIGHTY YEARS OF AGE: GLACIER NATIONAL PARK

His name may suggest the most timid of animals, but his courage is that of the king of beasts. The Northern Indians are very fond of ermine, and cut the skin in strips and hang them on every available part of their costume.

Photograph by Garrison

A FIELD OF POPPIES

No other region in the world possesses greater richness of color or such a vast number of species of wild flowers as the United States. All of the art of Persia has never produced such magnificent carpets as one may see spread over ten thousand landscapes within our boundaries.

Autochrome by Franklin Price Knott

THE HOPI BASKET-MAKER

The untutored art of the American Indian, with its lively appreciation of color values and combinations, and of geometric designs, has been praised by the art critics of every land.

Autochrome by Franklin Price Knott

A WATER CARRIER OF ACOMA, NEW MEXICO

Acoma is said to be the oldest continuously inhabited village in the United States. Its people defied the Spaniards before Jamestown or Plymouth Rock appeared in history.

Autochrome by Franklin Price Knott

HOPI INDIAN AND HIS HOME

The brilliant red of his blanket proclaims the success of the Southwestern Indian in producing fast colors. Some tribes are able to make multi-hued blankets with the delicate shadings of the finest art embroidery, the weaving being so perfectly done that one cannot tell which is the right and which the wrong side.

Autochrome by Franklin Price Knott

A TWENTIETH CENTURY PHIDIPPIDES OF THE HOPI TRIBE

Not even the messenger to Sparta showed greater endurance than the pure-blooded son of the American desert. Many of the Hopi Indians ran daily to and from their little farms, often ten or twelve miles away from the barren mesa where they live.

Autochrome by Franklin Price Knott

A CENTURIES-OLD STAIRWAY, ACOMA, NEW MEXICO

The same races that built the splendid structures of Yucutan and Chiapas constructed the pueblos of Arizona and New Mexico, and that they did their work well is shown by the way it has defied the teeth of time.

Autochrome by Franklin Price Knott

SUN BOW, PUEBLO CHIEF, OF TAOS, NEW MEXICO

This noble specimen of his race, though wearing a war bonnet, is a man of peaceful pursuits. He and his people are not wards of the Government, for they hold their lands under early Spanish grants, and have always managed their own tribal affairs and property.

Autochrome by Franklin Price Knott

THE SOUTH PUEBLO OF THE TAOS INDIANS: NEW MEXICO

This is a big community house, the home of about three hundred industrious people.

Photograph by Kiser

LAKE McDERMOTT AS SEEN FROM MANY-GLACIER CAMP: THE GLACIER NATIONAL PARK

Hundreds of gigantic peaks of the Rocky Mountains crowd one upon the other through the length and breadth of Glacier Park. The richly colored cliffs afford an excellent background for flocks of snow-white mountain goat and mountain sheep, which have been so carefully protected in this park that these beautiful creatures, so rare elsewhere in America, are here quite common.

Autochrome by Franklin Price Knott

MEDICINE MEN COMPOUNDING THEIR POTIONS, GLACIER NATIONAL PARK

"Big Springs" and "Black Bull," the medicine men of the Blackfeet Indians, are among the best examples of their race. "Black Bull" wears his hair unbound as the badge of mourning for the death of a child

Autochrome by Franklin Price Knott

THE BIRTHPLACE OF THE RAINBOW

Man cannot unscramble eggs, but a single drop of water can unscramble light, and the effect of this process at the Bridal Veil Falls of the Yosemite is both sublime and beautiful. The Yosemite contains four other falls as magnificent as the subject of this picture, the Vernal Fall (drop 317 feet), the Nevada Fall (drop 594 feet), the Illilouette Fall (drop 370 feet), and the Yosemite Falls (upper fall, drop of 1430 feet; lower fall, drop of 320 feet). The Bridal Veil Falls has a drop of 620 feet. Each one of these five remarkable waterfalls surpasses in grandeur and the magic play of light and water, any waterfall of Switzerland or on the continent of Europe.

Autochrome by Franklin Price Knott

CONSIDERING THE LILIES: MT. SHASTA IN THE DISTANCE

Mount Shasta, according to an Indian legend, was the first mountain made by the Creator as His masterpiece, and with this as a model He designed the other mountains of the world. The ascent of Shasta is difficult, but with competent guides is not perilous. With the little town of Sisson as a base, there is a good horseback trail to Timberline Camp, an overnight rest six miles away. Starting from this camp very early the next morning, the experienced mountaineer can make the ascent and return to Sisson in a day.

Photograph by A. H. Barnes

A WINTER SUNRISE, RAINIER NATIONAL PARK

This view shows the southern slope of Tatoosh Range, the height of which may be judged from the statement that the foreground itself is more than a mile higher than the Pacific at high tide.

Photograph by A. H. Barnes

A WASHINGTON LANDSCAPE: MOUNT HOOD SIXTY MILES AWAY. AND MARYHILL IN THE FOREGROUND

Between snow-capped mountains, broad rivers, magnificent highways, splendid farms, and inspiring landscapes, the West Coast and the Inland Empire offer rich rewards to the tourist who loves the grand, the sublime and the beautiful. The Columbia River Highway, in Oregon, is well named "America's Greatest Boulevard," and, from an engineering standpoint as well as from the scenic wonderland which the road unfolds as it cuts through two great mountain ranges to the sea, is unsurpassed by any highway in the world.

Photograph by A. H. Barnes

BIG TREES IN RAINIER NATIONAL PARK

After all, it may be the big tree that will explain one of civilization's greatest mysteries. Under the scientists' micrometer it is telling us of striking fluctuations of climate in bygone ages, and introducting a new factor in that most profound and far-reaching of the problems of history—the cause of the rise and fall of nations.

Photograph by A. H. Barnes

ALPINE FLOWERS IN RAINIER NATIONAL PARK

The flowers of our mountains match the sunset skies for color, the sands of the sea for numbers, and the filmy-winged butterfly for grace.

Photograph by Kiser

A SAPPHIRE IN A MOUNTAIN SETTING: BLUE LAKE IN THE GLACIER NATIONAL PARK

What American engineers have done at Gatun, glaciers have done in our high mountains. A glacier lake is often a dam-obstructed river, the dam being built out of the earth-shavings resulting from the flowing onward sweep of the mountains of ice.

being the same in temperature, color, or composition."

The Yellowstone National Park has a canyon gorgeous with all the colors and shades of the rainbow, and is the best stocked wild-animal preserve in the world (page 372).

THE GLACIER NATIONAL PARK

The situation of Glacier National Park is unique, in that it mothers streams which flow into three out of five of the earth's great oceans. It may well claim to be the top of the continent, for its rivers drain into Hudson Bay and the Arctic Ocean, into the Pacific, and through the Missouri and the Mississippi into the Atlantic.

As the Blackfeet Indian Reservation adjoins the park, the visitor has the added touch of charm that Indian life gives to any wild place (see pages 386-393 and 403).

The Glacier National Park was made by the earth cracking in some far-distant time and one side thrusting up and overlapping the other. It has cliffs several thousand feet high, and more than sixty glaciers feed hundreds of lakes. One lake floats icebergs all summer. The scenery is truly Alpine (see pages 402 and 410).

Lake St. Marys, Lake McDermott (page 402), and Lake McDonald are the peers of any of the mountain lakes of Switzerland and Italy. This park covers an area of 1,534 square miles, and maintains such an excellent chain of chalets, hotels, and trails that the tourist can see its many attractions in comfort.

THE PARKS IN COLORADO

The Rocky Mountain National Park straddles the Continental Divide at a lofty height, with snow-capped mountains extending from end to end. This park is in the heart of the Rockies northwest of Denver, with Longs Peak as its center. It was established by congressional enactment last year. Estes Park, the gateway to this mountain playground, is a beautiful little valley town nestled at the foot of the ridge, and yet itself more than a mile and a half above sea-level. Longs Peak is nearly three miles high, and has several neighbors that run it a close second.

The Mesa Verde National Park hides in its barren canyons the well-preserved ruins of a civilization which passed out of existence so many centuries ago that not even tradition recalls its people.

Here one may study the modes of life of the prehistoric American as they can be studied in few places. These aborigines had their civic center and they had some progressive ideas in city planning. Community life was the order of those times. One house had 200 rooms for family use and 22 for worship. Another once sheltered 350 aborigines. The Sun Palace, discovered by Dr. Fewkes in 1915, is an ambitious structure, apparently dedicated entirely to the worship of the sun.

MT. RAINIER NATIONAL PARK

Mt. Rainier seems to keep perpetual guard over Seattle, Tacoma, and Olympia. Any one who has beheld its many moods, who has watched the ever-changing picture as varying lights have played upon its summit, who has coasted on its glacial rivers, can understand why the Indians called it "Tahoma—the mountain that was God."

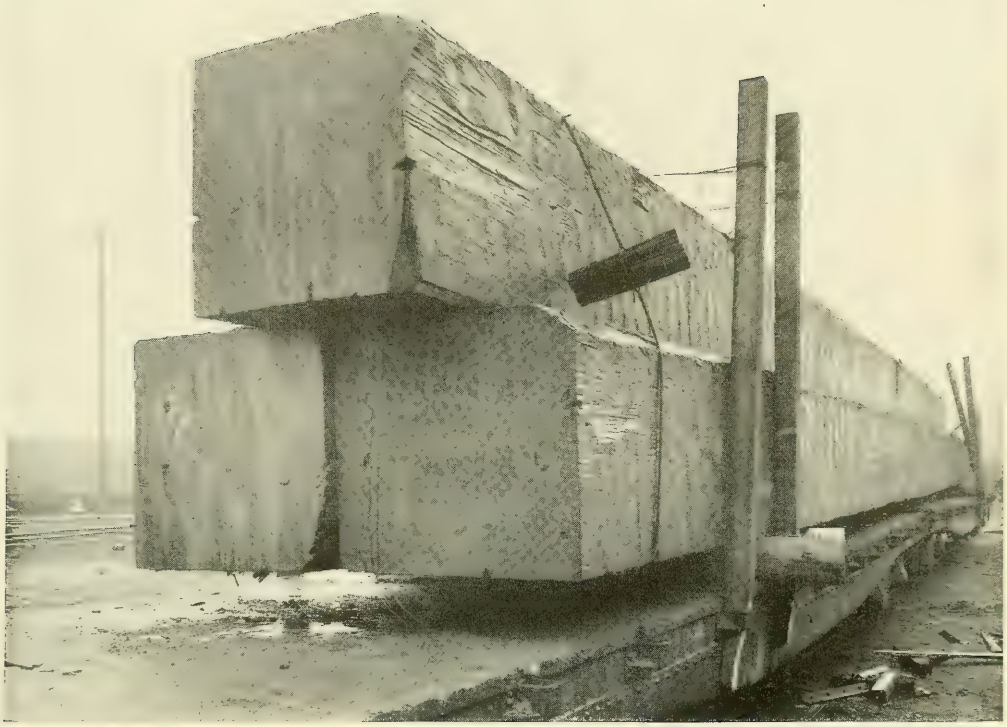
The Far Northwest was once a region of terrific volcanic activity. Mt. Shasta, Mt. Hood, Mt. St. Helens, Mt. Adams, Mt. Rainier, and Mt. Baker all stand in one far-flung group as silent witnesses of the dim ages when America was in the making and when they sent their beacon lights across the sea.

Where once flamed the fervent fires of earth's boiling caldrons, today snow and ice reign supreme; where once floods of molten lava swept, today forests of fir, pine, and cedar and gorgeously carpeted flower beds refresh the tourist.

Mt. Rainier has a glacier system exceeding in size that of any other single mountain within continental United States. From its summit and cirques twenty-eight named and a number of unnamed rivers of ice pour slowly down its sides. These rivers of ice have carved on what was once a perfect cone fourteen valleys through the solid rock. A bird's-eye view taken from above the mountain would show it to be covered by

THE GIANT FOREST IN THE SEQUOIA NATIONAL PARK: CALIFORNIA

The extraordinary redwoods of California grow on the western slopes of the Sierra Nevada. Many splendid specimens are to be seen in the Yosemite National Park, but they are found in the greatest numbers in the Sequoia National Park, reached via Visalia, California



Photograph by Curtis & Miller

WESTERN LOGS USED AS DREDGE TIMBERS AT PANAMA

So superior are the trees of the West for masts that they are in demand in almost every shipyard in the world. In the words of Muir: "They are felled and peeled, dragged to tidewater, raised again as masts and yards of ships, given iron roots and canvas foliage, decorated with flags, and sent to sea, where in glad motion they go cheerily over the ocean prairie, in every latitude and longitude, singing and bowing responsive to the same winds that waved them when they were in the woods. After standing in one place for centuries they thus go round the world like tourists, meeting many a friend from the old home forest; some traveling like themselves, some standing head downward in muddy harbors, holding up the platforms of wharves, and others doing all kinds of hard timber work, showy or hidden."

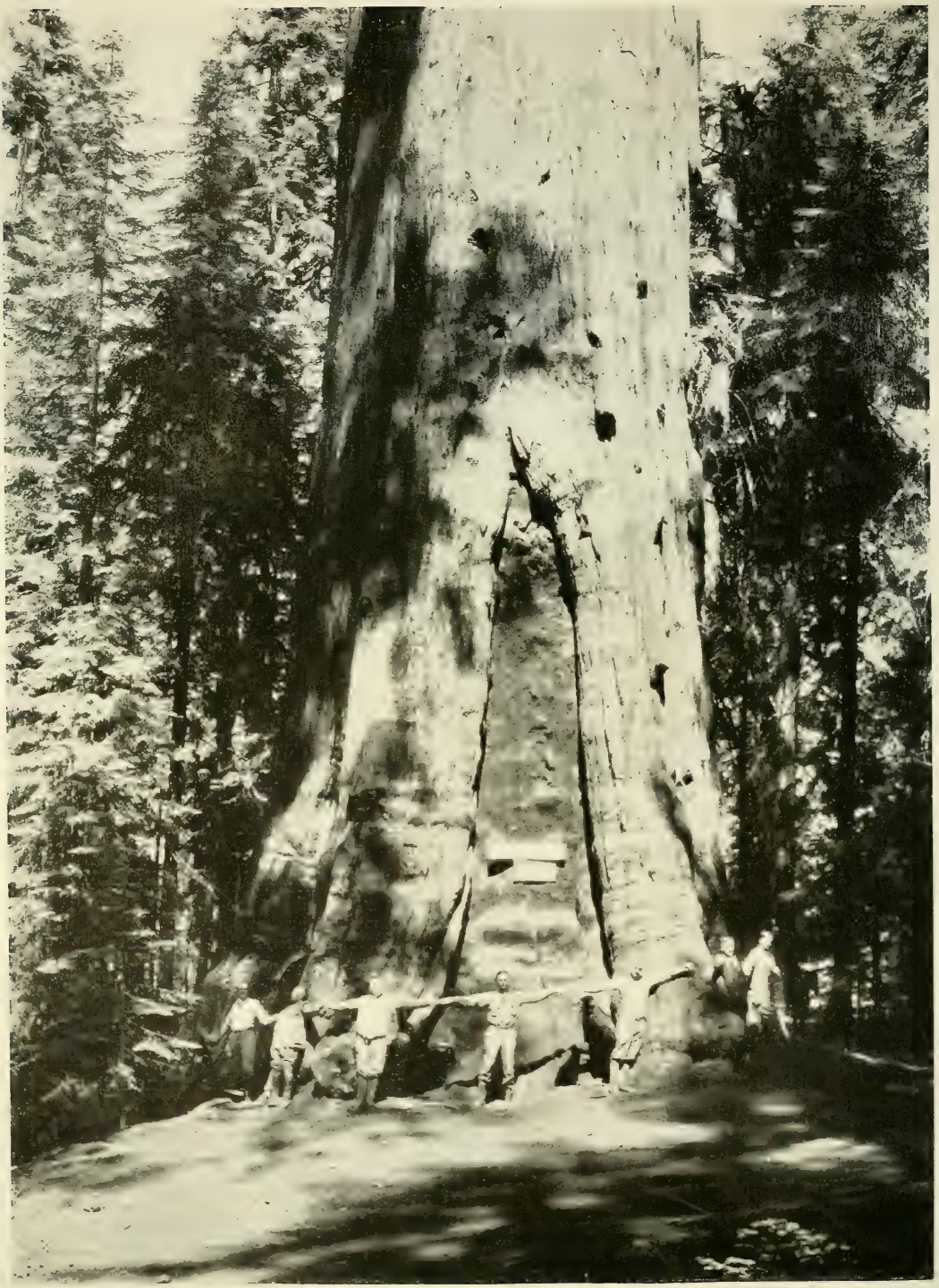
an enormous frozen octopus, stretching icy tentacles down among the rich gardens of wild flowers and through forests of fir and cedar (pp. 406, 408, 409, 427).

THE YOSEMITE AND SEQUOIA NATIONAL PARKS

No words can adequately describe the majesty and friendliness of the giant redwood trees of the Sequoia and Yosemite National Parks, the stately granite domes and sharp pinnacles, the roaring white cascades, the deep, dark canyons; the fragrance of meadows carpeted with lupine, columbine, evening primrose, mariposa lily, shooting-star, pride of the mountain, etc., and the many sweet-scented pines and cedars, among which are flitting countless songsters dressed in as lovely colors as the flowers.

In this fairyland, the lover of outdoor life can camp for months in summer without taking tent or raincoat, for it never rains here in vacation time.

Switzerland, the playground of Europe, visited annually (until 1915) by more than 100,000 Americans, cannot compare in attractiveness with the High Sierra of central California. Nothing in the Alps can rival the famous Yosemite Valley (pages 401, 416, 417), which is as unique as the Grand Canyon. The view from the summit of Mt. Whitney surpasses that from any of the peaks of Switzerland. There are no canyons in Switzerland equal to those of the Kern



Photograph by Gilbert H. Grosvenor

GENERAL SHERMAN, THE KING OF ALL TREEDOM: SEQUOIA NATIONAL PARK

It takes twenty men with arms outstretched to encircle the tree. The General Sherman tree is pronounced by the United States Government the biggest tree in the world, measured by the amount of wood it contains (see also the remarkable photograph by Eddy printed as the frontispiece to this number).

Photograph by Lindley Eddy

IN THE GIANT FOREST OF THE SEQUOIA NATIONAL PARK, CALIFORNIA

The "General Sherman" Tree, shown on the preceding page and in the frontispiece, belongs to the greatest grove of trees anywhere in the world—the Giant Forest of the Sequoia National Park. The General Sherman fortunately stands on public land, but the majority of the redwoods of the Giant Forest are privately owned. Though it was to preserve this incomparable group of trees that the Sequoia National Park was created by Congress in 1890, funds have been lacking to buy about 1,000 acres scattered through the grove, in 40-acre tracts, on which stand most of the best trees. The owners have expressed a willingness to dispose of their lands to the government and have given options on their holdings, but Congress has never appropriated the money for their purchase. If Congress does not soon appropriate the $50,000 required, it is to be hoped that sufficient funds may be raised by private subscription to buy the private holdings in the park and donate them to the National Government. While these splendid trees are in private hands, there is always the possibility of their destruction.

Photograph by Pillsbury

THE GATEWAY TO THE YOSEMITE, WITH EL CAPITAN ON THE LEFT AND THE CATHEDRAL ROCKS AND POHONO FALLS ON THE RIGHT

Photograph by Gabriel Moulin

EL CAPITAN: YOSEMITE NATIONAL PARK

Towering 3,600 feet above the Merced River, which mirrors back its beauty and its majestic lines, El Capitan, that vast block of unjointed granite, each of whose several faces shows a surface of more than 160 acres, stands in stately silence, one of the noblest rocks on earth—a literal rock of ages.

Photograph from Dewitt Hutchings

MAGNOLIA AVENUE: RIVERSIDE, CALIFORNIA

Riverside is known as the "orange capital," for from it are shipped more oranges than from any other distributing center in the world—5,000 carloads of oranges each year. Here were planted, nearly fifty years ago, the two navel orange trees, imported from Brazil, from which are descended all the seedless oranges of California.

and the King rivers, which contain scores of waterfalls and roaring streams, any one of which in Europe would draw many thousands of visitors annually. Many of the big yellow and red pines, of the juniper and cedar, eclipse the trees of Switzerland as completely as these pines are eclipsed by the giant redwoods.

And then, as to birds and flowers, the High Sierra so excel the Alps that there is no comparison. Never will the writer forget the melodies of the birds and the luxuriance of the meadows passed in the marches from Redwood Meadow to Mineral King, and then up over Franklin Pass; the fields of blue, red, yellow, orange, white, and purple flowers, all graceful and fragrant, or the divine dignity of the great Siberian Plateau, nearly 11,000 feet above the sea, and yet carpeted from end to end with blue lupine and tiny flowers.

From the educational point of view, the High Sierra so surpass the Alps that again no comparison can be made. In one day's ascent we observed fauna and flora to see the equivalent of which on the Atlantic coast we would have to make a journey of perhaps 1,500 miles. When we started in the morning we were hearing birds that correspond to the latitude of Charleston, S. C.; in a few hours we had traveled northward to Newfoundland and Labrador, and then descended to camp amid feathered friends whose counterparts are found around the writer's farm near Washington, D. C. A day later we ascended Mt. Whitney, the highest peak in the United States, and had a glimpse of birds of the Arctic Zone.

A VIEW OF LAKE TAHOE

Snow-capped mountains and lakes of every shade of blue are scattered throughout our great Northwest in wild profusion. Seeing one after another does not dull one's appreciation of them, however; it only exhausts one's vocabulary. We cross the ocean to see the much-advertised lakes of Scotland and Ireland, which, though picturesque, are eclipsed by scores of lakes in our own land from the Atlantic to the Pacific.

Within the boundaries of the Yosemite and Sequoia National Parks tower the oldest of living things—the *Sequoia gigantea* (see the supplement and pages 412, 414, and 415).

It is an unusual experience to stand under these big trees, to gaze upon their stately proportions, to reflect upon the storms and stress they have survived, and to visualize the strange changes in human history that have taken place since they were seedlings. Long before Moses had led the Children of Israel out of Egypt, long before his brethren had carried back to their father Joseph's blood-stained coat of many colors, long even before the birth of the patriarch whose children and whose children's children to the remotest generations the Most High promised to bless, even before the aged

Photograph by Pillsbury Picture Company

THE LOWER WATER-WHEEL FALL: TUOLUMNE RIVER CANYON, CALIFORNIA

The water, sweeping madly down the Tuolumne River, now and again strikes a spoon-like depression in the hard, sloping granite, which gives it an upward and circular whirl. At high water these astounding perpendicular whirlpools are fifty feet or more in diameter.

Pyramids had reared their heads on the banks of the Nile, long centuries before the Hanging Gardens of Babylon had been constructed, these trees had begun to grow.

Thousands of years the General Sherman tree has stood, offering its head to every passing thunder cloud; but so strong and sturdy is it that, like Ajax, it can defy the lightnings. John Muir gives us a graphic picture of a sequoia in a storm: "When the storm roars loudest, they never lose their godlike composure, never toss their arms or bow or wave like the pines, but only slowly, solemnly nod and sway, standing erect, making no sign of strife, none of unrest, neither in alliance nor at war with the winds, too calmly, unconsciously capable and strong to strive with or bid defiance to anything."

The sequoia is said to be one of the two surviving species of a once numerous genus which, before the Glacial Period, spread across the American continent and occupied Europe as well. The only other survivor is the redwood of the California coast (*Sequoia sempervirens*).

The wonders of the Yosemite National Park are easily accessible via the Yosemite Valley, where accommodations are provided for every degree of income. Desmond camps and excellent government trails enable the visitor to see the giant trees, water-wheels, and canyons, while the more adventurous, who desire to ascend Mount Lyell and its magnificent neighbors, will find entertainment in Tuolumne Meadows, at the hospitable headquarters of the Sierra Club, an organization of mountaineers who have revealed the Sierra to the world. The "General Sherman" tree is in the Sequoia National Park, reached by an automobile trip of 65 miles from Visalia.

Our national parks belong to the American people and are administered by the Department of the Interior. The Secretary, Franklin K. Lane, and the Assistant Secretary in charge of the parks, Stephen T. Mather, realize that as playgrounds for recreation and instruction

Photograph by Gilbert H. Grosvenor

IN THE OLYMPIC FOREST: WASHINGTON STATE

It is worth a trip across the continent just to see the monarchs of the forests of California, Oregon, and Washington. The coniferous forests of these States surpass all others of their kind in the world, not only in the size and beauty of the trees, but in the number of species assembled together and the grandeur of the mountains they are growing on. The placard on the tree is one of the Forest Service warnings about fire. "Observe *the six rules* for the prevention of *fires* in the *mountains*. *Rule One:* Be sure your match is out. Break it in two before you throw it away. *Rule Two:* Don't throw away burning tobacco. *Rule Three:* Make your camp-fire small and in a safe place. *Rule Four:* Put out your fire with water and then cover it with earth. *Rule Five:* Don't make large bonfires. *Rule Six:* If you find a fire, put it out. If it's too big, notify a ranger."

our national parks are without rivals on any continent, and are successfully striving to make them as available to our citizens as Italy and Switzerland have made theirs. Though the parks are remote from the Atlantic coast, they are not so distant as the playgrounds in Europe, and are reached by the tourist much more easily and quickly.

Our country is the treasure-house of nature's scenic jewels, containing so many and such an infinite variety of marvels that thousands of our matchless treasures cannot even be mentioned in this brief article: hot springs, as salubrious as any across the ocean; broad, hard, white beaches like the automobile course at Ormond, superior to any in Europe; coast scenes like those at Mount Desert, Marblehead, Mount Tamalpais, Santa Barbara, San Diego; an inland waterway which parallels the Atlantic coast and is almost continuous from Massachusetts to Florida, with possibilities for aquatic enjoyment unequaled except in our own wondrous Puget Sound; canals pictur-

Photograph by Fred H. Kiser

CROWN POINT, ON THE GREAT COLUMBIA RIVER HIGHWAY THROUGH THE CASCADE MOUNTAINS TO PORTLAND AND THE SEA

"The Columbia, viewed from the sea to the mountains, is like a rugged, broad-topped, picturesque old oak, about six thousand miles long and, measured across the spread of its upper branches, nearly a thousand miles wide; the main limbs are gnarled and swollen with lakes and lake-like expansions, while innumerable smaller lakes shine like fruit among the smaller branches."—JOHN MUIR (see also page 407).

Photograph by Miller

PART OF ONE DOUGLAS-FIR TREE

The great fir trees of the Northwest furnish a good proportion of the nation's lumber for structural uses. From these huge trunks enormous timbers, free from knots, are secured for bridge-building, derricks, and other engineering work. Planing mills use quantities of this lumber, and houses, freight cars, and ships are built of it. This tree would make over four miles of plank an inch thick and a foot wide.

Copyright by Miller Photo Co.

UPPER KLAMATH LAKE, OREGON, WITH MOUNT MC LOUGHLIN (OR MOUNT PITT) IN THE BACKGROUND

Upper Klamath Lake excels in the profusion and beauty of its water birds. Great snowy pelicans float about on its waters like graceful yachts. There are countless great blue herons, coots, snipe, mallards, kingfishers, and different varieties of ducks, all protected by the game laws of the State of Oregon, whose citizens long ago realized the large asset they had in their wild life and have protected it. Upper Klamath Lake is reached via Klamath Falls.

Photograph by Curtis & Miller

COASTING ON THE SNOW FIELDS OF RAINIER NATIONAL PARK, WASHINGTON

Photograph by Merl La Voy

COLUMBIA GLACIER: ALASKA

Norway contains no fiords or glaciers comparable with many in our own Alaska, nor Switzerland mountains as grand as Mount McKinley

Photograph by Curtis & Miller

A VIEW OF CHILDS GLACIER: ALASKA

Alaska's glaciers are the largest in the world outside of the polar regions

Photograph by Carl J. Lomen

AMERICA'S "LAND OF THE MIDNIGHT SUN"

When Nature passed round her gifts to the nations, even a "land of the midnight sun" was not denied America; for in all that vast territory in Alaska lying north of Fort Yukon and the Seward Peninsula the sun never sets in the summer nor rises far above the horizon in winter. The picture shows its position at midnight in summer and at midday in winter.

Photograph by Curtis & Miller

MOUNTAINEERS DESCENDING MOUNT BAKER, WASHINGTON, ON AN ANCHORED LIFE-LINE

No one needs to go to Europe for mountain-climbing, for the United States can offer climbing of any desired degree of difficulty. And what a satisfaction to scale your own mountains instead of somebody's else!

Photograph by Putnam & Valentine

WATER-LILY POND AT HOLLYWOOD, CALIFORNIA

The boy on the right is also giving baby brother a "sail"

esque as any in Holland, such as the mountain gorges and blue-grass pastures of the Chesapeake and Ohio Canal from Washington to Cumberland, or the historic Mohawk Valley of the Erie Canal—a desert with colors as heavenly as those of the Sahara and, though devoid of picturesque camels and Arabs, adorned with the most extraordinary cacti and desert vegetation on earth, and studded with marvelous works of the human hand like Salt Lake City; great fresh-water lakes, on which you can take a voyage of one thousand miles on ocean liners; Alaska, possessing the grandest glaciers in the world outside the polar regions, fiords more impressive than Norway's, and mountains like Mt. McKinley, which towers nearly one mile higher than the loftiest peak in Europe.

Any of our readers could spend an entire lifetime seeing nature's masterpieces within our boundaries and not reach the end of the catalogue.

VOL. XXIX, No. 5 WASHINGTON MAY, 1916

THE NATIONAL GEOGRAPHIC MAGAZINE

FURTHER EXPLORATIONS IN THE LAND OF THE INCAS

The Peruvian Expedition of 1915 of the National Geographic Society and Yale University

BY HIRAM BINGHAM, DIRECTOR OF EXPEDITIONS

IT WILL be remembered that it was in 1911 we commenced systematic exploration in southern Peru, in the country made famous for American readers by Prescott's celebrated classic, "The Conquest of Peru." On that expedition, which was primarily intended to search for the capital of the last Inca, Manco, who had rebelled against the Spaniards and fled into the most inaccessible part of the Andes, we discovered a considerable number of unknown ruins in a virtually unexplored region north of Cuzco. Our most important discovery was that of the wonderful city of Machu Picchu, which had been lost for so many generations that, with the exception of a few local Indians, no one in Peru was aware of its existence.

In 1912 we returned to the same country and spent several months at Machu Picchu clearing it from the forest and jungle and making such excavations as were necessary in order to restore it as far as possible to its original appearance, except that we did not attempt to put roofs on the ruins.*

In the meantime we had also discovered, through the observations of our topographers, that the surrounding country had been previously mapped with such great inaccuracy as to make the region between the rivers Apurimac and Urubamba appear to be much smaller than it was in reality. Owing to the precipitous nature of the mountains and the profound depths of the valleys and canyons (see the illustrations, pages 480-485), it was impossible for us then to penetrate the highlands immediately adjacent to Machu Picchu. We did not know whether there might not be some other place of equal or greater importance; we were unable to state how the people of Machu Picchu entered their city, or whether they had highways leading to other parts of the country.

In 1914 a considerable part of the neighboring region was mapped, some of the ruins which had been first visited in 1911 were surveyed, and, best of all, the presence of an old Inca road leading in the direction of Machu Picchu was reported.

Of their queer record stones, attractive pottery and bronzes, and of what we had been able to discover as to the history of the city by searching the ancient Spanish chronicles, members of the National Geo-

* See "The Wonderland of Peru," with 250 illustrations, in the April, 1913, number of the NATIONAL GEOGRAPHIC MAGAZINE.

Photograph by Hiram Bingham

THE PRINCIPAL BUSINESS CORNER IN CUZCO

On the left are the walls of the convent of La Merced, built in large part of stones taken from ancient Inca structures at the time of the Spanish conquest. The advertisement thereon announces to the people even up in these remote mountain highlands the sufferings of the Belgians and bids them come to a benefit for the Belgian Red Cross at the Cuzco motion-picture theater. Prices were high and most of the people were poor, but the theater was crowded. In the middle of the picture are two llamas on their way to the market-place with produce. At the right is the establishment of Don César Lomellini, an Italian merchant, who has befriended our expedition in every way and has for several years acted as our agent in Cuzco without charge. On his wall is the advertisement that exchange on Lima may be bought at par. He is not only a banker, but sells everything from sugar mills to American candy. Further down the street, under the flagstaff, is the Cuzco post-office. The corner balcony of the Lomellini building, upstairs, opens out of Don César's private apartments. The next two balconies, on the left, open out of the warerooom which he put at the service of the expedition.

Photograph by Hiram Bingham

INDIAN BOYS, WITH VERY ELABORATE PONCHOS, VISITING CUZCO

Cuzco is the Mecca of all the Indians in southern Peru, and one of the most interesting sights in its streets are the visitors, whose district may be told by the cut of their garments and the patterns they affect. Here are shown three visitors from a distant province, who were very shy and only with the greatest difficulty could be persuaded to pose for their picture. Had it not been for the good nature of the porter, or *cargador,* who stands at the left, we could never have persuaded them to face the camera.

graphic Society were told in the February, 1915, number of this Magazine.* But of the food or the flora and fauna of those remarkable builders, who constructed splendid granite palaces and remarkable agricultural terraces in this long-hidden corner of the Andes, we were able to give very little information.

OUR PLANS FOR OUR LAST EXPEDITION

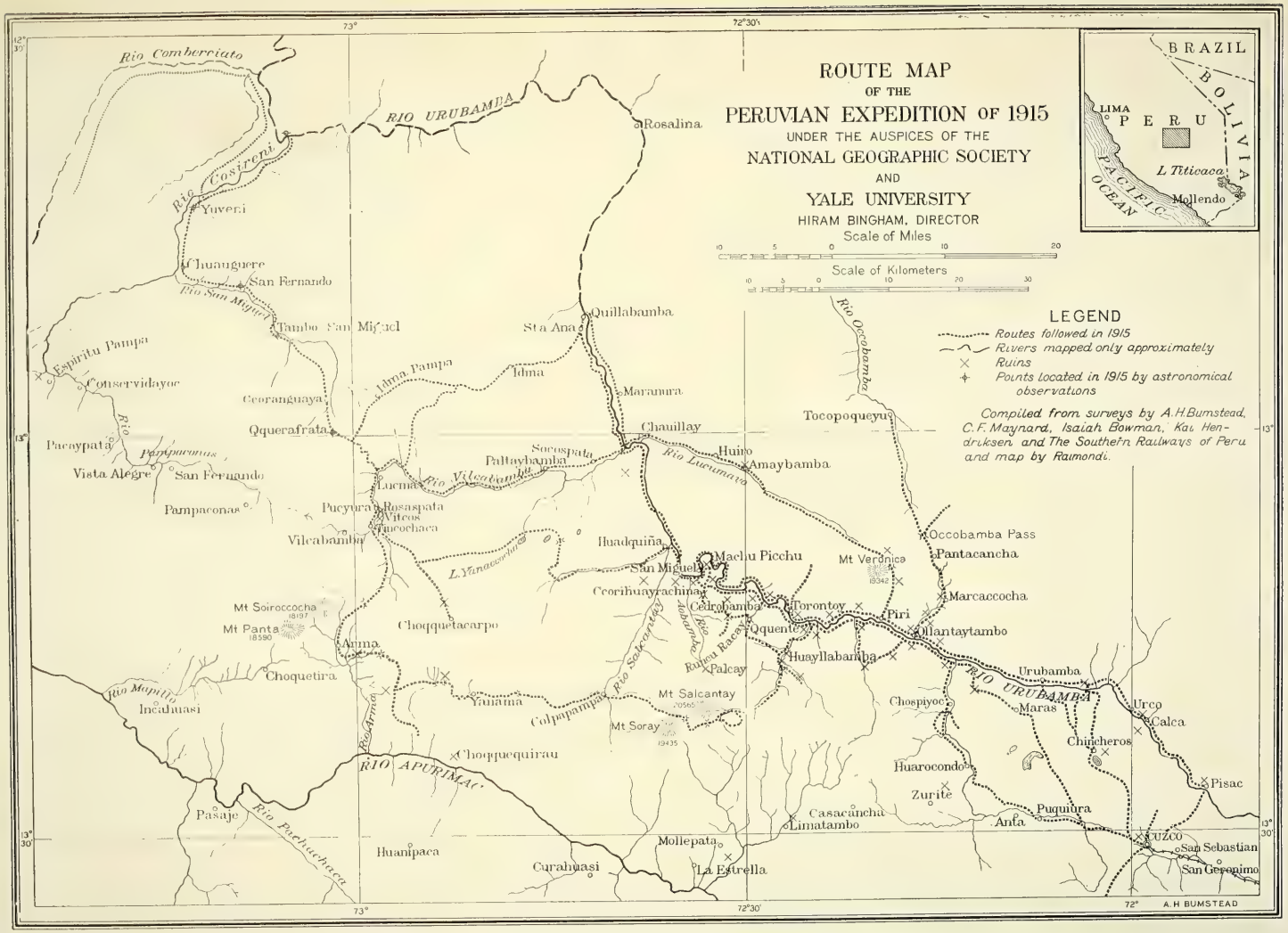
Accordingly, the Expedition of 1915 had for its chief object the securing of as much information as possible about the former inhabitants of Machu Picchu and the territory immediately surrounding the city.

Thanks to the coöperation of the Bureau of Plant Industry of the United States Department of Agriculture, we were able to investigate the original food plants of this vicinity and learn what medicinal plants were known and prized.

* See "The Story of Machu Picchu," with 60 illustrations, in the NATIONAL GEOGRAPHIC MAGAZINE, February, 1915.

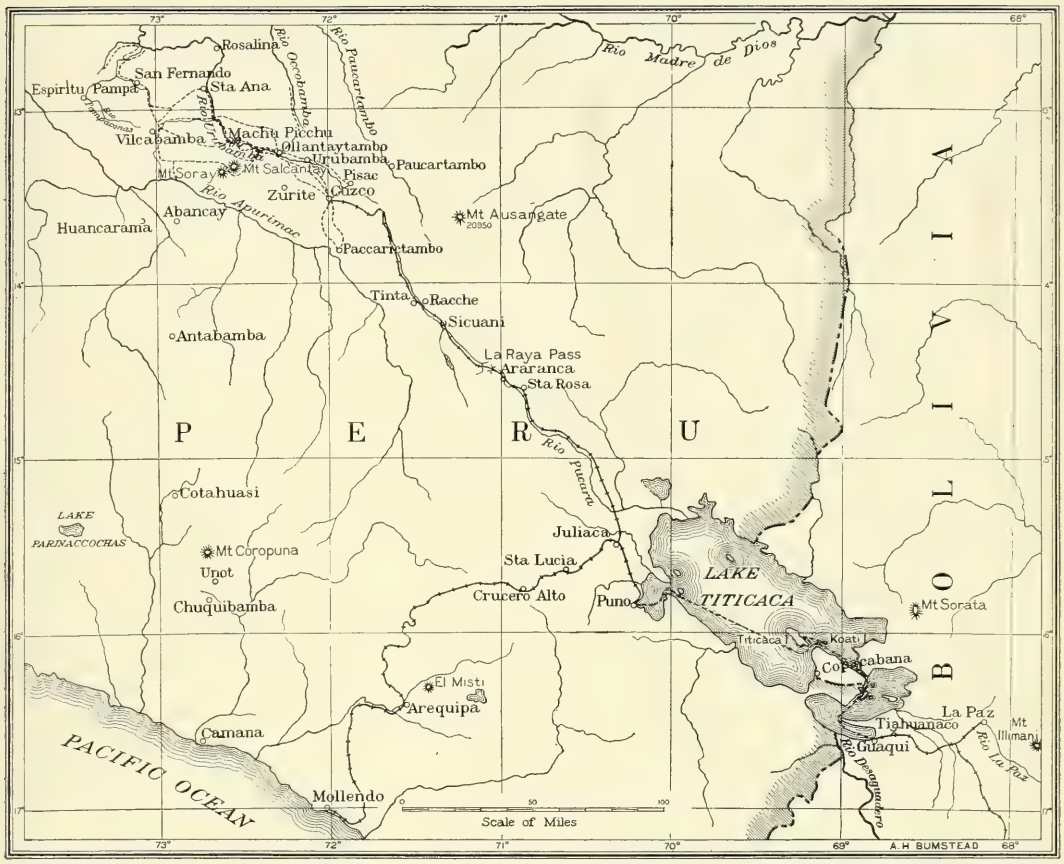
We also secured the services of a competent naturalist to tell us with what birds and animals the people of Machu Picchu were familiar. Furthermore, we succeeded in locating several ancient roads leading toward Machu Picchu (pages 446 and 447), and while following them out discovered several new groups of ruins, evidently representing outlying fortresses and fortified stations used for the defense of the capital and for the convenience of travelers on the highways. Finally, by process of elimination, we were able to prove that Machu Picchu was the capital of a considerable area of country that was once densely populated.

In the course of our work we crossed a number of hitherto-unexplored areas, collected large numbers of botanical and zoölogical specimens, mapped a new river system, and took measurements of nearly all of the savage inhabitants of the newly visited valley, besides many of the semi-civilized folk of the older valleys.



ROUTE MAP SHOWING TERRITORY EXPLORED IN 1915

This map, which is a larger scale representation of the territory in the extreme northwestern portion of the one on the opposite page, shows by dotted lines the routes followed by the Expedition of 1915 in its work of exploring and mapping that section of the highlands of Peru which has Machu Picchu for its center. By locating Cuzco, in the southeastern corner of this map and in the northwestern corner of the other one, the reader can connect them without difficulty.



SKETCH MAP OF SOUTHERN PERU

This map shows that part of Peru in which the National Geographic Society-Yale University Expeditions were particularly interested. The work of the 1915 Expedition was limited to that narrow stretch of territory shown in the extreme northwestern portion of the map west of Cuzco and north of Abancay, and represented in greater detail in the map on the opposite page.

ADVANTAGES OF HAVING A MANY-SIDED STAFF

Since we have now concluded our studies in the region about Machu Picchu, it may be of interest to the members of the National Geographic Society, who have so generously supported these expeditions, to learn something of our methods of work. In explorations in foreign lands a certain amount of time must be wasted. There is tedious work to be done in establishing friendly relations with the foreign government, securing the requisite permits and introductions, forming satisfactory connections with reliable local business houses, purchasing the necessary equipment and supplies, securing efficient and trustworthy native assistants, etc.

The amount of bother and trouble is not materially increased by having a reasonably large expedition, so we have always deemed it decidedly worth while from the point of view of economy to have as many branches of science as possible represented in our party.

There are other obvious advantages to be gained by having men of distinctly different tastes and training working together in a new territory. While each man cannot cover the entire country, his opportunity is broadened by the possibility of one of the other members of the party being able to report to him the

Photograph by Hiram Bingham

PART OF THE LOWER LINE OF FORTIFICATIONS IN THE FORTRESS OF SACSAHUAMAN, NEAR CUZCO

The gigantic size of these huge stones and the extraordinary care and precision with which they are fitted together without mortar or cement by the ancient megalithic builders make this great fortress the most striking monument in the New World to the remarkable perseverance and engineering skill of the American aborigines. This picture shows a small part of the fortress illustrated in the marvelous panorama printed as a frontispiece to this number of THE GEOGRAPHIC.

presence of new material that he would otherwise have missed seeing.

For instance, on this last expedition the most interesting fossil—a portion of the shell of a gigantic antediluvian "land turtle"—was found by one of our civil engineers in the office of a village magistrate whom he was visiting for reasons of diplomacy. The head and skin of a fine puma or mountain lion, the largest and perhaps one of the rarest mammals in Peru, was secured not by the naturalist, but by the surgeon while on a journey to see a very sick priest some 40 miles from our headquarters. Had it not been for the surgeon's willingness to go far out of his way in attending to this call of charity, our collections would not include a puma. It happened that a belt of forest, probably the highest known in the world, was located by the director while on a reconnaissance trip through a region which the botanist was unable to reach. On the other hand, the botanist was the first to observe an interesting feature in the fortress near Cuzco, namely, a groove cut across a cornerstone so as to add to its symmetry by making it appear to be two stones instead of one. The naturalist spent several weeks in an unsuccessful attempt to locate the presence of a spectacled bear, until one was accidentally found by the director while engaged in archæological reconnaissance along one of the old trails leading to Machu Picchu.

Thus it will be seen that a single party, devoted to the study of one subject, is at a disadvantage even in its own specialty, as compared with an expedition composed of several parties of observers trained in various fields of investigation.

The Expedition of 1915 included the following: Hiram Bingham, Ph. D., *Director;* O. F. Cook, of the Bureau of Plant Industry, U. S. Dept. of Agriculture, *Botanist;* Edmund Heller, B. A., *Naturalist;* Clarence F. Maynard, C. E., *Topographer;* David E. Ford, M. D., *Surgeon;* Osgood Hardy, M. A., *Interpreter* and *Chief Assistant;* Elwood C. Erdis, *Chief Engineer;* J. J. Hasbrouck, Ph. B., *Engineer;* Geoffrey W. Morkill, *Assistant in Charge of Headquarters;* G. Bruce Gilbert, of the Bureau of Plant Industry, U. S. Dept. of Agriculture, *Assistant Botanist;* Ricardo Charaja, *Assistant to the Director.*

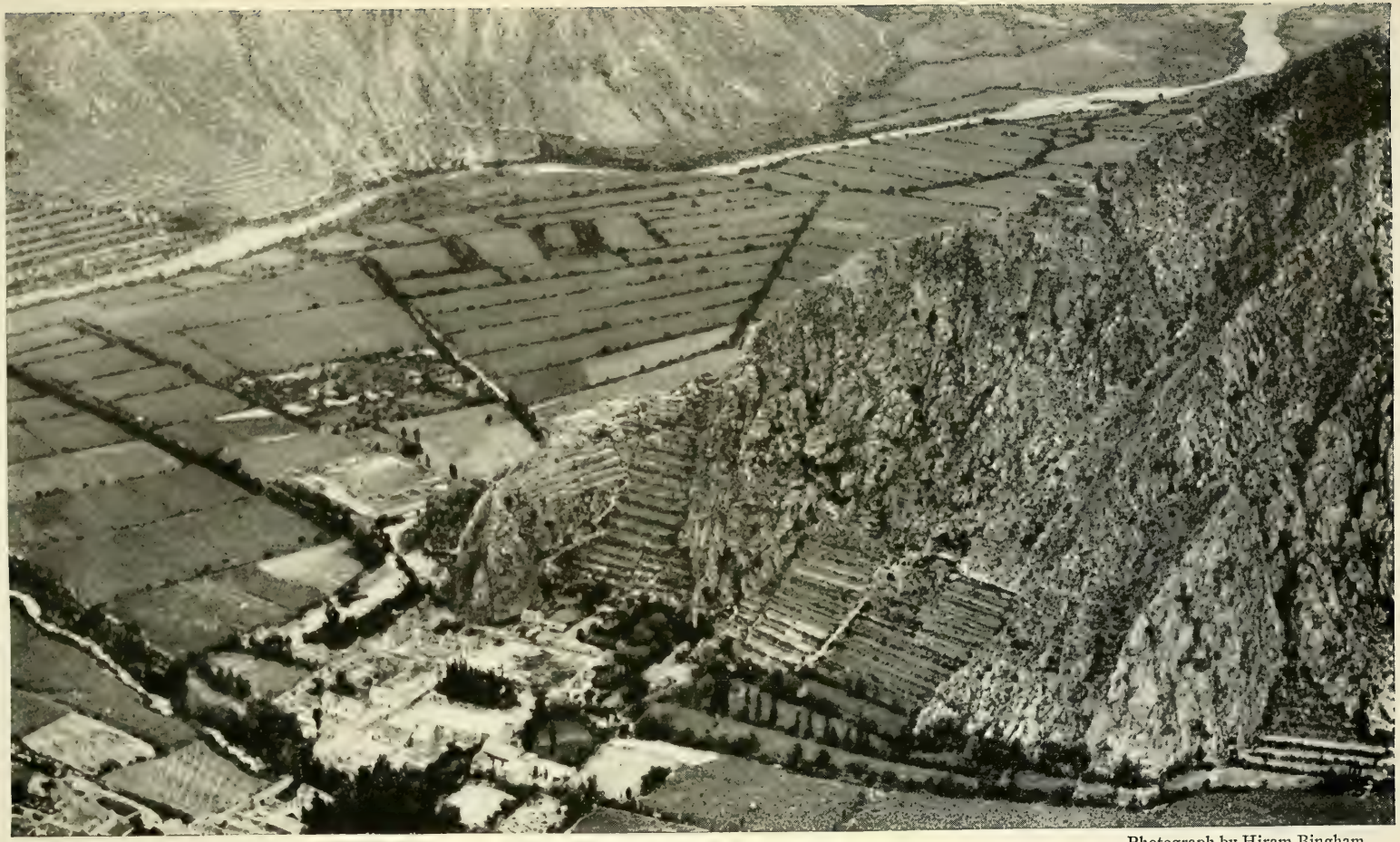
In addition, we had such native guides, muleteers, and soldiers as were necessary. We used 50 mules and 5 horses.

On the 1911 Expedition Prof. H. W. Foote, of the Sheffield Scientific School of Yale University, had coöperated with me in assembling a balanced ration in "unit food boxes." The object of this plan was to facilitate the provisioning of our parties by packing in a single box everything that two men would need in the way of provisions for a period of one or two weeks, depending on the size of the case. We found that the larger box was too heavy, so in 1915 only the smaller size was used. These boxes have given such general satisfaction, not only to the men themselves, but to the surgeons who had the responsibility of keeping us in good condition, that a few words in regard to this feature of our equipment may not be unwelcome at this point.

THE NECESSITY OF VARIED AND WHOLESOME FOOD

Many people seem to think that it is one of the duties of an explorer to "rough it" and "trust to luck" for his food. I had found on earlier expeditions that the result of being obliged to subsist on irregular and haphazard rations was most unsatisfactory. While "roughing it" is far more enticing to the inexperienced explorer than the humdrum expedient of carefully preparing, months in advance, a daily bill of fare that shall be sufficiently varied, wholesome, and well balanced, the results of such "trusting to luck" are very unsatisfactory.

The truth is that providing an abundance of well-selected and properly cooked food adds very greatly to the efficiency of a party. It means far more trouble and expense for the transportation department, and some of the younger men on our parties sometimes feel that their reputation as explorers is likely to be damaged if it is known that strawberry jam, sweet chocolate, cheese, and pickles are frequently found on their bills of fare! But experience has shown that



Photograph by Hiram Bingham

A BIRD'S-EYE VIEW OF OLLANTAYTAMBO

Here the Peruvian Expedition of 1915 made its headquarters, in a rejuvenated Spanish building, seen in the center foreground at the right of the long church. The ruins in and about Ollantaytambo are among the most interesting in South America, and consist not only of fairly recent Inca structures, less than 400 years old, but of megalithic remains of unknown antiquity. The end of the promontory was strongly fortified and almost impregnable. The banks of the Urubamba River in the distance are terraced. The Urubamba Valley at this point is still intensely cultivated on remarkable great terraces that were laid out by the Incas and their predecessors many centuries ago (see "Staircase Farms of the Ancients," by O. F. Cook, in this number).

the results of "trusting to luck" and "living as the natives do" means not only loss of efficiency in the day's work, but also lessened powers of observation and diminished enthusiasm for the drudgery of scientific exploration.

Exciting things are always easy to do, no matter what you are living on, but frequently they produce less important results than tasks which depend upon daily drudgery; and daily drudgery depends upon good daily food.

THE QUESTION OF RATIONS

In 1915 each unit food box, as we have intimated, provided a balanced ration for two men for eight days, breakfast and supper being hearty, cooked meals, and luncheon light and uncooked. It was not intended that the men should depend entirely on the food boxes, but should vary their diet as much as possible by whatever the country affords, which in southern Peru frequently means potatoes, corn, eggs, mutton, and bread. Nevertheless each case contained sliced bacon, tinned corned beef, roast beef, chicken, crushed oats, milk, cheese, salmon, coffee, sugar, rice, army bread, salt, sweet chocolate, assorted jams, pickles, dried fruits, and vegetables. By seeing that the jam, dried fruits, soups, and vegetables are well assorted, a sufficient variety is procured without destroying the balanced character of the ration.

On account of the great difficulty of transportation in the southern Andes we have had to eliminate from the unit cases foods that contain a large amount of water and relatively little nutriment, like French peas, baked beans, canned fruits, etc., however delicious and desirable they may be. We found it possible, however, to add somewhat to the variety by providing in our warehouse at headquarters a few cases of luxuries which could be drawn upon from time to time, including such things as butter, tea, catsup, kippered herring, sausages, and pancake flour. Whenever a party went out for a new trip they were encouraged to take several pounds of "extras" along, in order to break the monotony of the food boxes. Undoubtedly there is much to be gained in keeping up the spirits of the men by providing an appetizing variety on the table.

The most highly appreciated article of food in the entire list was oatmeal, which, on account of being partially cooked, is readily prepared in an attractive manner, even at high elevations, where rice cannot be properly boiled.

On the other hand, it was difficult to satisfy the members of the expedition by providing the right amount of sugar. At the beginning of the field season the allowance—one-third of a pound per day per man—seemed excessive, and the director was criticized for having overloaded the boxes with too much sugar. But after a month in the field the allowance proved to be too small and toward the end of the expedition had to be supplemented.

In addition to the food, we have found it advisable to include in each box a cake of laundry soap, two yards of dish toweling, and three empty cotton-cloth bags, to be used for carrying food, collecting specimens, etc.

PRECAUTIONS AGAINST DISEASE

While the food taken on an expedition largely determines the general health of the members, it cannot entirely take the place of medicines and bandages. Each camping party was provided with a "first-aid" outfit, and every man carried in his personal luggage a pocket medicine case containing quinine, aspirin, bismuth, compound cathartic, bichloride of mercury for wounds, and permanganate of potash for snake bites.

Furthermore, from previous experience we knew that it would be a great advantage to the expedition to establish a small dyspensary at headquarters, where the residents of the vicinity would be welcome and where a small supply of drugs and bandages would always be accessible. We knew that our headquarters would be at least 30 miles from the nearest drug store. Accordingly, our medical equipment was selected with this in mind. In addition, our surgeon was supplied with an African tropical field equipment, carried in a steel chest designed to withstand the hardest kind of usage and to meet all ordinary emergencies.

Photograph by Hiram Bingham

ANOTHER VIEW OF OLLANTAYTAMBO, SHOWING FORTRESS ON THE LEFT AND THE SO-CALLED "SCHOOLS" ON THE RIGHT

As an additional precaution, all members of the party were vaccinated against both smallpox and typhoid, two diseases that are likely to be prevalent in every town in the Andes. The men were particularly cautioned against drinking water taken from irrigating ditches and canals, and against drinking native beverages where the source of the water might be questionable, and against eating too freely of uncooked native fruits and such products as crude native sugar or chocolate.

The general supplies included tents provided with heavy canvas floors sewed to the walls, and mosquito nets, making the tents practically insect- and snake-proof; saddles, made especially for the narrow-backed Andean mules and fitted with cruppers and two heavy girths to prevent slipping on the steep trails; halter bridles (Peruvian saddle animals will rarely, if ever, drink without having the bit taken out of their mouths; so that the halter bridle, with its bit connected by snap-hooks, is a great convenience); pack covers to keep the loads dry during the frequent rainstorms; duffle bags of the heaviest possible material; fiber cases, and air-tight steel boxes.

Besides these things, we were prepared to furnish each member of the party with blankets, snow-glasses, folding bucket, folding wash-basin, cot, aluminum cooking outfit, small kerosene stove with Primus burner, folding brass lantern, sewing kit, canteen, pocket tool-kit, rubber poncho, Winchester rifle, Colt revolver, camera, tripod, and photographic record and calculator.

ESTABLISHING NEW HEADQUARTERS

On former expeditions we established our headquarters at Cuzco, the capital of the Incas at the time of the Spanish conquest, and one of the most interesting cities in the Western Hemisphere.* Since Cuzco is the capital of one of the largest departments in Peru, the site of most of our work, there we had the advantage of being able to keep in touch with the chief political and military authorities whenever trouble has arisen (see page 432).

In 1915, however, we decided to establish our headquarters at Ollantaytambo rather than at Cuzco, because it has a better climate (being at an elevation of only 9,000 feet above the sea instead of 11,000 feet), has plenty of good water—an important factor, considering the amount of pure water needed for photographic purposes, as well as for ordinary household use—and was a long day's journey, or 33 miles, nearer to Machu Picchu and the valleys where most of our work was to be done.

THE HOUSE OF THE YANKEES

Chief Assistant Hardy, who had left New Haven with the Expedition of 1914 and had been spending much of the intervening time studying Quichua, the language of the Incas (at present spoken by a majority of the inhabitants of the highlands), finally succeeded in renting a small place for our headquarters. It was located between the attractive stream which comes roaring down the Ollantaytambo Valley and an irrigation ditch which furnished an abundance of good water. Although not actually in the heart of the town, it was only a few minutes' walk from the telegraph station and was next door to the church and the priest's house (see page 438). Reverting to the language of the Incas, we called it Yankihausi, or the House of the Yankees.

When Mr. Hardy leased the place, there was, besides a garden and a small paddock, only a single building that was considered habitable even by the Indians. There had been other buildings, but they were in ruins and unspeakably filthy. The available building was a two-story structure. It had two rooms on the ground floor, occupied by Indian families and coated with the smoke of decades of cooking fires. One room was pointed out as the place where an Indian woman had once been beaten to death. The doors were low and narrow, so small in fact as to be well-nigh useless for light or ventilation. There were only two windows in the entire structure. Pigs and chickens,

*Peru is divided not into States and counties, but into departments and provinces. The prefects of departments are answerable only to the President and have great power.

Photograph by Hiram Bingham

PACK TRAIN ON THE PLAZA: OLLANTAYTAMBO

The frayed broom projecting out from the wall over the heads of the Indians in the picture is the Peruvian method of telling the world that the place is a public house where beverages of various degrees of alcoholic strength may be had

dogs and guinea-pigs roamed with impunity all over the premises.

The only building materials that could be obtained were adobe bricks of sun-baked mud, to be made from the earth and litter dug up in the courtyard, rough, unsawed Eucalyptus, grown in the vicinity, corrugated iron roofing, and Oregon pine, both of which had to be brought at great expense on muleback from Cuzco.

As a sample of the difficulties encountered in the construction of Yankihausi, Mr. Hardy writes in part:

"At the beginning of the work I had an hallucination that I could apply Yankee methods to the building of 'Yankihausi,' but this faded away after an unsuccessful attempt to teach the peons to use a wheelbarrow! The earth for the mortar was dug up with a short-handled, acute-angled hoe. Much treading served to mix straw with the mud and give it the right consistency. Both mortar and stones were carried to the wall in goat-skins, where they were put in place by a mason whose utensils were a plum-line and a trowel. Two Indians mixed the mortar, three carried it to the wall, and two brought stones; so that seven laborers were employed in tending the mason.

"Furthermore, I was never able to overcome the waste caused by frequent interruptions for meals. Arriving without having breakfasted, the laborers ceased work for an hour in the forenoon to eat. Again at noon work stopped, this time half an hour for chicha and coca. About 4 in the afternoon supper was the excuse for still another rest!

"Throughout the work I was blessed with the friendly criticism of all the 'cavaliers' in the immediate vicinity. Some of this was constructive, but for the most part it was merely destructive and served only to test my powers of courtesy. All agreed that the house could not be finished in the time at my disposal.

"However, in spite of these 'Job's comforters' and such delays as feasts, which made it impossible for the Indians to work certain days, and the excommunication put upon our laborers by the local *cura,* who had conceived some wrong ideas as to the purpose of our coming to Ollantaytambo, the work went steadily on, and by April first, after five weeks' work, Yankihausi was finished and ready for occupancy."

A DAILY VARIATION IN TEMPERATURE OF 50 DEGREES

"While the health of the party was generally good," writes Surgeon Ford in his report, "with no serious illness, there were numerous disorders due to or modified by climatic conditions, or by the unusual mode of living.

"Our life was constantly in a country which varied in altitude from 2,000 feet to 17,000 feet; temperatures were encountered varying from 119 °F. to 22° F. Even in the highest altitudes there was a daily variation of as much as 55° F.

"Fleas, lice, and three varieties of biting flies were sources of much discomfort. The prevalence of typhus among the Indians toward the end of the season—one case among our own men—caused some anxiety. Affections of the respiratory passages seem to be the most prevalent diseases in the higher altitudes. There is a universal dread of 'lung trouble.' Typhoid is always present in the towns. Summer diarrhea among the children and dysentery are common.

"Typhus is endemic in the Urubamba Valley. It was epidemic during the latter part of our stay there. I had twelve cases.

"Smallpox is always present and no precautions are taken against it. Most of the adults (of Spanish blood as well as Quichuas) having had it in childhood, are immune, but it is a great cause of infant mortality.

"Open ditches in the streets are sewers, drinking-water supplies, and baths for pigs. Once at our base camp we found a fresh cowhide in our well! It had been put there, as part of a tanning process, by men who had been with two previous expeditions. These men, most intelligent of their class, could not be made to realize that the water might be injured."

There were many narrow escapes occasioned by landslides and bad trails. We lost several mules, but no men. One of our military escorts, Tomas Cubinas, shot himself accidentally through the foot in

Photograph by Hiram Bingham

THE SIX MONOLITHS OF THE FORTRESS AT OLLANTAYTAMBO

Frowning down on our headquarters were the ruins of the great megalithic fortress, the most remarkable feature of which is this wall of six huge blocks of reddish granite; the interstices between are fitted with narrow blocks of the same material. It seems not unlikely that this ancient wall was intended to convey a sense of the majesty of the king who ordered its construction, and also a record of achievement. Although there are no real hieroglyphics to be found on its surface, it will readily be seen that there were at one time very distinct carvings and patterns that have now become barely visible, even in a strong cross-light. Unfortunately, some modern Peruvians have endeavored to achieve immortality by carving their names on these wonderful relics of the powerful megalithic civilization that preceded the Inca empire. The stones were quarried several miles away.

Photograph by Hiram Bingham

INCA PRINCESS' BATH, NEAR 1915 HEADQUARTERS: OLLANTAYTAMBO

August, the bullet passing through his instep and affecting some of the small bones. He has recovered. One day, as Mr. Heller was crossing the Cosireni River on one of the rickety native bridges, which requires a person to proceed on all fours, like an ape, the savage carrying the shotgun exploded it accidentally when midway across, the shot striking between Mr. Heller and the Machiganga Indian. Some of the shot cut the skin of his hand and another landed in my cheek, while the savage was struck below one eye by a shot reflected from the rocks near the bridge.

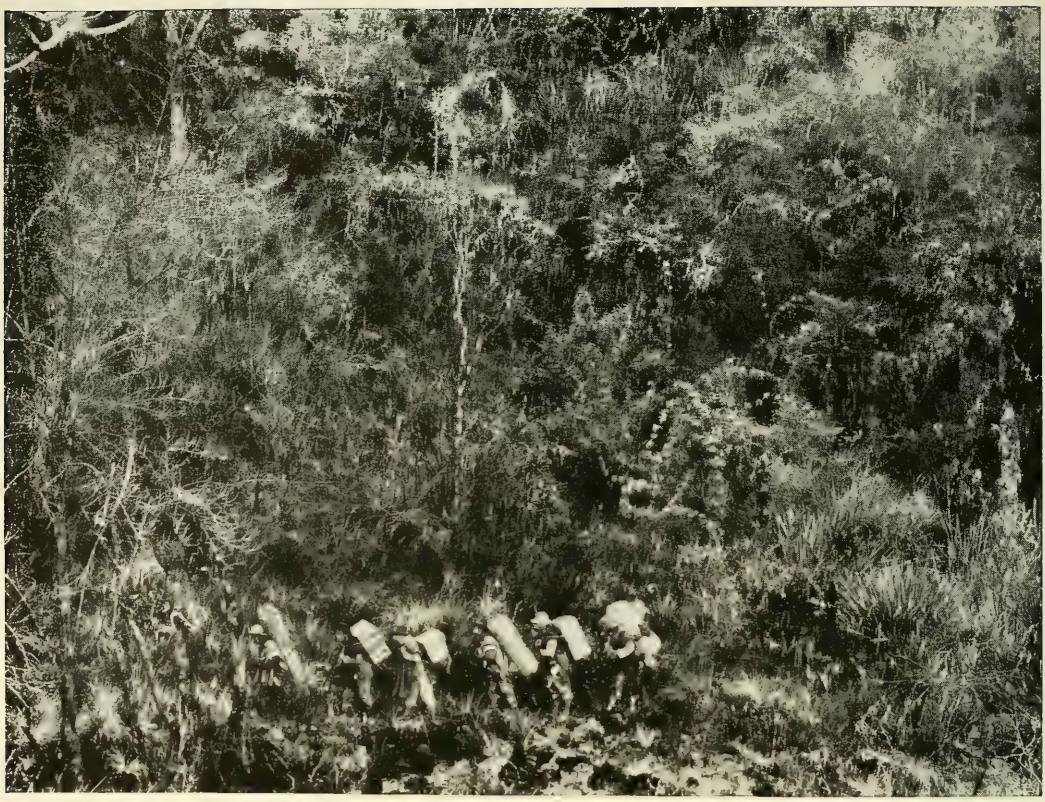
THE SEARCH FOR OLD HIGHWAYS LEADING TO MACHU PICCHU

The most thrilling moment in my four expeditions into the interior of Peru was at Machu Picchu, on the 24th of July, 1911, when I first saw the Temple of the Three Windows and the Chief Palace.

In order to reach them, it had been necessary to follow an Indian guide through a dense jungle, and finally along precipices where one literally had to hold on with one's finger nails. Clearly this was not the way that the builders of Machu Picchu had approached their city. There was another path on the other side of the ridge, but this trail was also one that could hardly be conceived of as a highway to the city, for in several places it has to depend on rickety little ladders and protruding roots.

Later we located part of an ancient road leading back from the city up the mountain side and across the face of one of the towering precipices on Machu Picchu Mountain. It appeared to proceed in a southerly direction into a region of high mountains, deep valleys, and well-nigh impassable jungles. In 1915 it was my privilege to penetrate that unexplored country back of Machu Picchu, visit its ruins, and follow its ancient trails.

The most important ruin in this region is called by the local Indians "Patallacta," or the "City on the Hill," at a place called Qquente, or "Humming Bird," which was probably the largest city tributary to Machu Picchu. We spent two months executing a careful survey of the town and making small ex-



Photograph by Hiram Bingham

OUR CARRIERS ON THE OLD INCA TRAIL TO THE LOST CITY OF THE INCAS

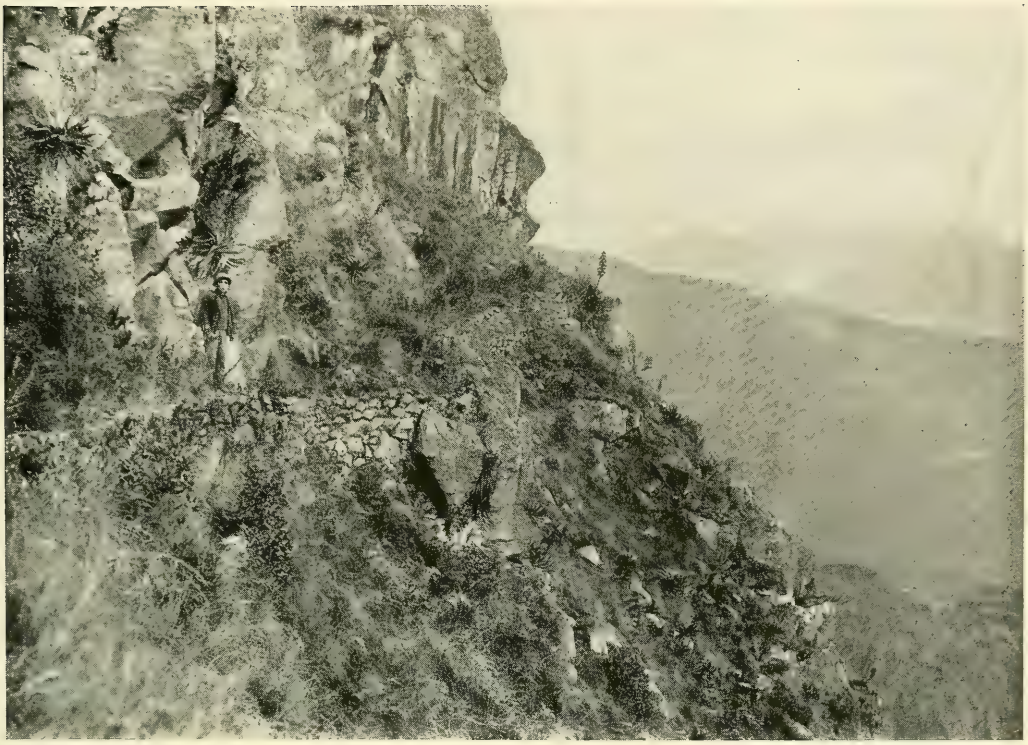
This trail connected the city of Machu Picchu with some of the more populous valleys in the vicinity and also with the distant city of Cuzco. It was opened with great difficulty by the Expedition of 1915, repaired in some places, and found to lead past several hitherto-unknown groups of ruins of minor importance.

cavations in each of its houses. In no case was it necessary to dig down more than a couple of feet, since what material there was lay very near the surface. This work was under the personal supervision of Mr. Elwood C. Erdis and Mr. J. J. Hasbrouck. Their task was well done.

Notwithstanding the extraordinary stories circulated among the Indians of our discovering gold images and other treasures of great value, no gold of any sort was found in any of the excavations at Patallacta, Machu Picchu, or elsewhere in Peru.

In the immediate vicinity of Patallacta we noticed many signs of ancient irrigating ditches, ruins of smaller villages, and occasionally ruins of well-built houses; but in no case is there anything as good as the best stone-work at Machu Picchu. The marked architectural characteristics of the Machu Picchu buildings, such as houses with gable ends, ring stones, niches, windows, projecting cylinders, and clan groups with lock-holes were well represented.

Not far from Patallacta, in the Huayllabamba Valley, we located the remains of an old Inca road leading out of the valley in the direction of Machu Picchu. It was with mingled feelings of keen anticipation and lively curiosity that Mr. Hardy and I, with a gang of Indian bearers from Ollantaytambo, in April, 1915, set out to discover how far we could follow this ancient road. After passing through a picturesque primeval forest, we came out in the upper part of the valley on grassy slopes, where we had no difficulty in tracing the remains of the ancient highway. It led to a pass at the



Photograph by Hiram Bingham

A PART OF THE OLD INCA TRAIL LEADING TO MACHU PICCHU

In places the trail was held in position by high retaining walls. The gradient was heavy and there were many long flights of stone steps (see page 448).

head of the Huayllabamba, and then down by a series of sharp zigzags into the Huayruru Valley, where not a soul lived and which seemed to be extraordinarily destitute of even wild animal life. It has the reputation of being extremely unhealthy.

We made our way through the bottom of the valley as best we could. The trail disappeared for a while in a maze of boulders and the remains of a fairly recent landslide, but we could see a road winding up the grassy slopes on the other side of the valley. We finally made out two roads and decided to take the one to the right, as that appeared to lead in the direction of Machu Picchu.

WE DISCOVER MANY MORE ANCIENT RUINS

Half way up the mountain side, 1,500 or 2,000 feet above the bottom of the valley, we came to a very interesting little ruin, the name of which the guide, who arrived a little later, told us was Runcu Racay. It was apparently a fortified station on the old highway.

From Runcu Racay the ancient highway led over another pass into the Aobamba Valley. In most places the road was in such condition that the mules could follow it with safety, but occasionally the poor animals would get bad falls and had to be entirely unloaded and helped up slippery or precipitous rocks. We had not proceeded far into the Aobamba Valley before we came to a fork in the road. The left branch led by a series of steps up a precipitous slope to a promontory, where we found a group of ruins, to which our guide gave the name of Cedrobamba. This was probably an important fortress, since it commanded the approach to Machu Picchu. It is surrounded by cliffs and is extremely difficult of access.

We made a small clearing in the valley near the ruins and camped here while the road was being made passable for the

mules. In several places bridges had to be constructed.

While the road was being opened I went on ahead with two native assistants, and was delighted to find that our trail clearly led in the direction of Machu Picchu. Pushing on in the hope of soon getting a glimpse of Machu Picchu Mountain, I stumbled on a group of ruins called "Ccorihuayrachina."

On the mountain side above the ruins a hilltop had been leveled off and a retaining wall built, so as to make it a useful signal station, or primitive fortress. Beneath it we found a huge cave. The next day, on coming around the bluff in sight of this cave, imagine our surprise and delight to see a black "spectacled" bear browsing in the shrubbery. This was the first time that any of us had ever seen an adult Peruvian bear feeding in the open.

The bear was slowly working around the ridge in our direction, and in the hope of getting a near photograph of it I slipped back out of sight and climbed as fast as I could. A rapid climb at that altitude (the elevation was about 12,000 feet) is not conducive to being able to hold a camera steady when the need comes. Unfortunately the bear climbed faster than I did, and, getting to the top of the ridge, was startled by the sight of our caravan approaching. All I saw of him was a momentary glimpse of two big ears and a black snout not 50 feet away. Before I could get the camera focused the apparition disappeared, and by the time I reached the top of the ridge our precious visitor was safely hidden in the densely wooded hillside below the crest of the ridge.

Naturalist Heller, learning of our encounter with the spectacled bear, later came into this region to hunt and secured several specimens of this rare bruin.

From Ccorihuayrachina the trail led along the crest of the ridge, slowly descending toward Machu Picchu Mountain (see illustration, page 480), but when within rifle shot of the city suddenly disappeared; but that did not worry us, for we had actually reached the immediate neighborhood of the celebrated hidden city by what was probably the ancient highway that connected Machu Picchu with Cuzco. In addition, we had also been so fortunate as to locate a number of hitherto-unknown ruins that represent stations at convenient intervals along the road.

A PERILOUS UNDERTAKING

As I had now other matters to attend to, I requested Mr. Maynard to see what he could do to complete the last link of the old road.

Describing his work, he writes as follows:

"We finally picked the trail up in a ruined guard-house farther along the ridge and followed it to a point where the side hill merged into a sheer rock wall. At the difficult places the Indians would try in every way to discourage further search, crying, 'No hay camino,' or 'Manan pasanchu,' meaning that 'There is no road,' 'You can't pass.'

"They worked only half-heartedly and had to be repeatedly encouraged.

"In searching for traces of the trail, one of the men finally uncovered a flight of stone steps buried in rotting vegetable matter. These steps led to a cave, the entrance to which had been concealed by bushes. By carrying their road through this natural tunnel, the Incas had avoided building on the face of the cliff. However, when we attempted to follow this route we found the passage choked by large rocks; the roof had caved in. The only possible means of advance was by swinging a short rustic bridge along the face of the cliff, which seemed rather dangerous and not too feasible.

"Sending a man back to camp for a rope, the rest were set to cutting poles which could be used to span the gap. Projecting from the face of the cliff about ten feet beyond the end of the trail and a few feet above it was a ledge of rock. Growing out of crevices at the end of this ledge, and also at the end of the trail, were two small trees. They were rather unsafe foundations, but they formed the only means of further progress. Poles were laid from tree to tree. One of the Indians then slid across, first having a rope tied tightly about his body, the other end being held by the men.

Photograph by Hiram Bingham

A HILLTOP TEMPLE

Among the ruins of lesser importance discovered in 1915 was this hilltop temple, located in a commanding position about 4,000 feet above the bottom of the Urubamba Valley, near Ollantaytambo.

Small sticks were lashed at right angles to the poles and where possible were wedged into cracks in the face of the wall. Brush and moss placed on this support completed the bridge, which was about two and one-half feet wide.

"After crossing we picked up the trail as it left the cave, until a point was reached where slides and dangerous precipices made further progress absolutely impossible. There was nothing to do now but give up all attempt to get through from this end. I therefore decided to descend into the canyon, go to Machu Picchu by the existing trail, and work back from the ruins toward the old road.

"We finally came across an Inca roadway leaving Machu Picchu by way of a deep gully. Cutting was not difficult here and we made rapid progress. The trail was the finest example of Inca road construction that I had seen. The road finally divided, one branch continuing up the mountain side, the other traversing its western slope. The latter proved to be the desired trail.

"After two days a path was finally driven down the eastern slope to our little bridge and the old road."

A few days later I had the satisfaction of picking up the old road where I had left off some weeks before and completing my journey into the city over all that is left of the ancient highway.

ANOTHER OLD HIGHWAY

The route followed by the early missionary priests on their visit to Vilcabamba the Old—a story referred to in the February, 1915, number of the NATIONAL GEOGRAPHIC MAGAZINE, on pages 180-183—we realized, probably lay across a large, unexplored area, unknown even

Photograph by Hiram Bingham

RACCHE OR RACCHIPATA: VIEW FROM ANOTHER OF THE SPRINGS

The ruins of the Peruvian highlands from the temples to the terraced mountains proclaim a race the destruction of whose annals was a calamity to mankind

to the local land-owners. We had heard rumors that there was a trail by which Indians sometimes came to the ranch of Huadquiña from the village of Pucyura, without going around through the Vilcabamba and Urubamba valleys.

So it was determined to make a circuit from Ollantaytambo, going between the beautiful snow peaks of Salcantay and Soray to the unexplored country lying between Yanama, Arma, and Pucyura, returning by way of the trail to Huadquiña, if it could be found.

Below Yanama we camped on a ridge near some small ruins. From here we made our way to Arma as best we could without guides, following trails that sometimes led nowhere and that at other times led deep into dense jungles and across mountain torrents.

On this trip I observed near Arma a forest located on the slopes of Mt. Soiroccocha, between 15,000 and 16,000 feet above sea-level—so far as we know, the highest forest in the world.

Near Pucyura, in the Vilcabamba Valley, on the hill called Rosaspata, or "Hill of Roses," where, in 1911, we discovered the ruins of Vitcos, the last Inca capital (see pages 511-520 of the April, 1913, NATIONAL GEOGRAPHIC MAGAZINE), we found encamped Messrs. Erdis, Hasbrouck, and Dr. Ford, of our expedition. They had uncovered an extraordinary amount of modern material, including horseshoe nails, scissors, Spanish brass saddlery decorations, and even jew's-harps, showing that the group of buildings back of the Palace of Vitcos was undoubtedly occupied by Spaniards in the colonial period.

Inquiry among the natives of the valley finally resulted in our securing the services of an Indian guide who said he knew the trail across the unexplored area to Huadquiña in the direction of Machu Picchu.

Our route lay up the Colpa Valley, which I had explored a few days before, passing by an abandoned quartz-crushing

Photograph by Hiram Bingham

CHILDREN BEFORE A BUTTRESS OF THE CHURCH: RACCHE OR RACCHIPATA

Showing the use of ancient carved blocks taken from the neighboring ruins of the temple of Viracocha. Their temples in ruins, their history destroyed, their civilization all but forgotten in spite of the fact that they gave to the present its most productive crop—the potato—the Peruvian Indian is a pitiable descendant of a noble race.

plant and discovering a long stretch of Inca roadway that leads in the direction of Choqquequirau by way of a pass called Choqquetarcarpo. This Inca roadway was in a remarkably good state of preservation, although slides prevented us from using it for our mules. Near it, and not far from the pass, we found the ruins of an ancient tavern, consisting of a group of half a dozen circular houses.

A WILD UNEXPLORED COUNTRY

From the Colpa Valley our guide led us into a wild puna country, where there were many lakes and numerous bogs. Had it not been for the remarkably fine weather of the preceding months, we should never have been able to pass through this region at all; in fact, it is undoubtedly on account of the large number and wide extent of the bogs which characterize this area between Pucyura and Huadquiña that it has so long remained unexplored by the Peruvians themselves.

At last the trail, which in many places followed the lines of an Inca highway, came to a dark green lake, larger than the rest, whose name I inquired of the guide. The answer gave me a thrill. As the guide shouted it back to me from the head of the caravan, I thought he said Ungacacha; in fact, it sounded more like this than Yanaccocha, or "Black Lake," its actual name, as I learned later.

Now, in the account of the journey of the two monks from Pucyura to Vilcabamba the Old just referred to, it was

Photograph by Hiram Bingham

PLOWING IN PERU

The picture shows a potato field being plowed by hand. The women turn the clods after they are loosened by a pair of man-power plows. This appears to represent the aboriginal method of cultivating the soil, but these spades are shod with iron or steel points. The handles are tied to the spades with leathern thongs. It is an Indian custom to hearten labor by working in common, and as many laborers as can be got together work on the same job at the same time. The enthusiasm that comes from working together relieves the monotony of the hard exertion in high altitudes.

stated that they had to pass a place called Ungacacha. Ever since our first journey into this region in 1911 I had been inquiring of Indians everywhere for a locality of that name, only to be met invariably with the reply that they knew of no such place.

It seems to me entirely probable that the place referred to in the Spanish chronicles was Yanaccocha, and that the monk, who probably wrote it down sometime afterward from memory, and who very likely did not hear it any more clearly than I did when I first inquired the name of the place, spelled it *Ungacacha,* instead of *Yanaccocha.* They look so different on paper that it is somewhat difficult to realize how closely the Indian pronunciation of one approaches the other.

That night we camped near a glacier at an elevation of about 15,000 feet and found that our sleep was considerably interfered with by the coldest weather we had yet encountered. The next day one of the mules overestimated the width of the narrow path and fell, carrying his rider with him. Both would probably have been killed by rolling down the precipitous hillside had it not been for the branches of a little tree which held them.

At the junction of two little valleys we found it necessary to turn away from the old Inca trail, which continued up the hillside in the direction of Machu Picchu and led toward the ruins of Yuracrumi-

Photograph by Hiram Bingham

NATIVE CUSTOMS: MESCCAY, NEAR QQUENTE

The mother carries her baby suspended in her shawl from her shoulders. When she wants to get rid of her burden she lines a little pen with the shawl and places the youngster in it. It stays there contentedly for hours.

yocc, which Professor Foote and I had visited in 1911. At that time we could not quite understand its significance, but now it undoubtedly appears to have been a station on the old Inca road between Machu Picchu and the Vilcabamba Valley.

MACHU PICCHU WAS THE CENTER OF A DENSELY POPULATED REGION

It thus appears that the builders of Machu Picchu had an elaborate system of highways throughout this little-known and almost unexplored country which lies between the Urubamba Valley and the Apurimac. This region was once densely populated, and Machu Picchu was its capital. There are no other ruins in the region that approach the Hidden City in magnificence, although there are a great many whose architecture bears a striking resemblance to the less important buildings in Machu Picchu itself.

Further study of the remains found at Machu Picchu has convinced us that we have here an essentially Inca city, using the term Inca in its most reasonable sense—that is, to designate the tribes and nations that occupied the major part of the central Andes from earliest times down to the Spanish Conquest.

The sequence of the various Andean races is extremely difficult to determine. There are no large sandy areas which, by gradually engulfing the life of a village, are later so convenient when the excavator comes to work out its stratification, as in Asia Minor and Babylonia. Landslides may sweep away in a few hours the accumulation of centuries, and overturn everything in such fashion as sometimes to place what is older actually

Photograph by Hiram Bingham

MAKING BLANKETS ON HAND LOOMS

This is an important ancient industry still widely practiced in the highlands of Peru. The picture shows the process of laying down the warp for a large blanket at an elevation of nearly 14,000 feet. The pattern is determined largely by the skill with which the warp is laid down.

above what is newer. The Spanish conquerors were a race of treasure-hunters, and they and their successors destroyed the majority of the evidence.

Lack of timber, the prevalence of heavy rains during part of the year, and the ease with which stone might be procured early led to the development of stone as a building material. Strength and permanence were secured through the keying together of irregular blocks. The upper and lower surface of these stones were frequently convexed or concaved, the convexity of one stone approximating the concavity of the adjoining stone.

In constructing their walls the pure arch was not evolved. They developed several ingenious devices, such as "lock-holes" for fastening the bar back of a door; "ring stones," which were inserted in the gables to enable the roofing beams to be tied on; projecting stone cylinders, which could be used as points to which to tie the roof and keep it from blowing off. The ancient builders also provided for ventilation and drainage (see the April, 1913, and February, 1915, numbers of the NATIONAL GEOGRAPHIC MAGAZINE).

POTTERY LIKE THAT OF GREECE

Sculpture in a rude form existed, but no well executed representations of the human body. They had some skill in copying animals' heads, but at best it was crude in comparison to the skill achieved by the coast peoples. A pair of dishes found in Machu Picchu, bearing as decoration roughly drawn butterflies painted in three colors, represents their highest attainment in ceramic decoration.

Their pottery is marked by simple and graceful lines, bearing a striking similarity to that of ancient Greece, and resembling in its simplicity and utility some of the modern vessels at present in use in French kitchens.

Owing to the extreme moisture of the climate, the remains of cloth are very few; but we know that the Inca peoples actually did arrive at a high degree of skill in the manufacture of textiles through their ability to procure the wool of the alpaca. By the use of hand looms artistic and intricate patterns were produced, and cloth of the utmost delicacy of texture was not uncommon.

Their metal articles were easily preserved, and so we have been able to learn that the people of Machu Picchu were extremely skillful makers of bronze.

The elaborate study of our collections by Professor Mathewson discloses the fact that the more delicate or ornamental pieces contained the maximum percentages of tin, since bronze with a high tin content yields the best impressions in casting.

Professor Mathewson believes that the early Incas were unfamiliar with refined methods of heat treatment, and so were compelled to sacrifice extra hardness and strength by increasing the tin content in large objects, which required considerable working. Apparently cold working was invariably depended upon to produce the final stiffness and hardness of an object. This necessitated a low tin content in such objects as axes, large knives, etc.

TREPANNING OF SKULLS WAS COMMON

Their surgical tools were probably of bronze or obsidian. Surgery appears to have been practiced to a considerable degree, if one may judge by the large number of trepanned skulls that we have found in caves within a radius of 25 miles of Machu Picchu. In some cases the cause of the operation appears to have been disease; in others evidence leads to the conclusion that the operation was intended to relieve pain caused by wounds received in battle. Since the favorite weapon of the Inca peoples was the sling, and clubs were common, it is not surprising that the skulls of many soldiers should have needed the relief that came from skillful trepanning.

In the art of war they exhibit skill in defense rather than offense. Fortifications constructed with salients and reentrant angles so as to admit of lateral fire were not uncommon; high walls, even dry moats, were not unknown. Forts were frequently located on sightly eminences commanding a fine view of all approaches (see pages 438 and 440).

They had no machinery and did not use iron or steel. They used levers and inclined planes. They also made huge

Photograph by Hiram Bingham

THE PLAZA ON SUNDAY AFTERNOON, SHOWING THE CHURCH BELFRY AND VEGETABLE MARKET: SANTA ROSA

Photograph by Hiram Bingham

NATIVE DRUG STORES OF THIS TYPE MAY BE FOUND IN THE MARKET-PLACES OF ALL THE LARGE CITIES IN THE PERUVIAN ANDES

The "druggist," usually a woman, has twoscore or more of remedies, each in a nicely decorated little woven bag. Some of the remedies are useful herbs; others are more fantastic, and include starfish and queer stones. About half of the remedies are supposed to be effective against the bad effects of fresh air and drafts!

Photograph by Hiram Bingham

THE PLAZA AND CHURCH OF PUCYURA ON THE ROAD FROM CUZCO TO ANTA: A GOOD EXAMPLE OF COLONIAL ECCLESIASTICAL ARCHITECTURE

fiber ropes, out of which they constructed long suspension bridges. They thought nothing of handling blocks of stone weighing five tons and upward. Indeed, there are numerous stones that weigh over 15 tons which were fitted together with a skill that has amazed all beholders (see the extraordinary Panorama of Sacshuaman, published as a frontispiece to this number, and also page 436).

It appears that the Incas and their influence throughout the Andes extended no farther north than the known limits of the llamas and the alpacas; in fact, the development of their culture may be said to have depended in large measure on their success in domesticating these varieties of the South American camel so long ago that no wild members of either species remain. Their ability to raise and train hundreds of thousands of llamas which could carry from 50 to 100 pounds apiece enabled the Inca peoples to carry out engineering and agricultural works far more difficult than they could have accomplished had they been obliged to depend on human burden-bearers.

THE SUN WAS THEIR CHIEF DIVINITY

In religion the Incas were fond of worshiping high places, fine views, and other striking natural objects, such as huge irregular boulders, waterfalls, and springs; the wonders of the air and the sky, such as rain, thunder, the starry firmament, the moon, and, above all, the sun. In a cold, mountainous region like the central Andes, it was but natural that the sun, so essential to the raising of crops and to the comfort of shivering humanity, should have been regarded as their chief divinity.

Of literature as such they necessarily had none. Like most primitive peoples, they had remarkable memories. Their language was probably the Quichua. Mr. Hardy, of our expedition, who has been studying it, says that "for one who has not learned it in childhood it is difficult because of the lack of any good grammar in either Spanish or English." He then continues:

"In the fifteen months at my disposal I learned enough to enable me to carry on the conversation necessary to secure information as to trails, ruins, rivers, towns, etc., and to pass some judgment on their orthography.

"My studies make me appreciate the value of Quichua in furnishing sidelights on the life and customs of pre-Spanish inhabitants. The abundance of expressions for all stages of drunkenness shows that the millennium did not exist. The absence of words meaning to buy and sell suggests the simplicity of their industrial life. The importance of agriculture is demonstrated by their having but one word (*llank'ay*) for our words 'work' and 'cultivate.' That they had not gone far in philosophy is shown by the lack of words to denote abstract qualities. 'Pacifism' was evidently known in those days, for *aucca* was used either for enemy or soldier.

"The adjective 'imperceptible' is made up of three words, *acco-sayay-huchaylla,* meaning 'the size of little sand.' An 'incorruptible' man is one who 'does not turn to one side,' *mana-huakllik.* To 'inherit' is literally 'to take the place of the dead one,' *huañukpa-rantin-yaycuy,* while a 'grave' is 'the heart of the earth,' *allpak-soncco.*

" 'Experience' is a 'ripe heart,' *pocuscca-sonccoy,* and to 'experiment' is to 'take hold on memory,' *yayay-happiy.* A 'fervent' man is one 'having a beautifully burning heart,' *sumak-raurak-soncco;* an 'inconstant' man has his 'heart on one side.' 'Foreigners' are 'those belonging to a city a great distance off,' *caru-carullaktayoc,* and a 'window' is 'a hole that sees,' *ccahuana-ttocco."*

So far as one may judge from the present-day music of the Andean peoples, Inca music was a very simple affair, limited to a few notes repeated continually in a minor key.

The family tie was very strong and still is. The extent to which members of a family will go in alleviating suffering and distress of distant relatives is perhaps the most striking and delightful trait in the South Americans of today.

STRANGE THAT SO ACCOMPLISHED A PEOPLE LEFT NO WRITTEN RECORD

Most unfortunate was their failure to develop an alphabet, or even some form

Photograph by Hiram Bingham

THE SCHOOL AT PUCYURA

When we visited the school the session was being held on the veranda, as the day was fine. The schoolmaster may be seen on the right.

Photograph by Hiram Bingham

SCHOOL CHILDREN OF PUCYURA

Nearly all the children are of mixed Spanish and Indian ancestry. They live in houses like those in the background, and others not so good. The children in the picture belong to the wealthiest residents of the vicinity. They are not dressed up for the special occasion; in fact, not even the teacher knew the picture was to be taken until a few minutes previous. This is the only school within a radius of nearly fifty miles, and many of the youngsters live so far away that they are obliged to board in the village.

Photograph by Hiram Bingham

A FLOCK OF YOUNG ALPACAS (WITH ONE WHITE LLAMA, IN THE CENTER, AND SOME SHEEP, TO THE RIGHT) SEARCHING FOR WATER ON THE PLATEAU, 15,000 FEET ABOVE THE SEA

On the high upland pastures between Lake Titicaca and Cuzco thousands of alpacas and llamas find their natural feeding grounds. They have been domesticated for centuries and do not exist in a wild state, but are always attended by shepherds. Alpaca wool is one of the choicest exports of Peru.

of hieroglyphic similar to that which existed in southern Mexico and Central America. It is remarkable indeed that a people who succeeded in equaling the ancient Egyptians in architecture, engineering, pottery, and textiles should have fallen so far behind in the development of a written language. This is the most serious obstacle that stands in the way of our learning more of that enterprising race.

MANY BIRDS LIKE OUR OWN

So much interest attaches to the people who built Machu Picchu that we were extremely anxious to learn all we could of the animals and plants with which these wonderful architects were familiar. What birds did they see? What animals furnished them sport? Which annoyed them? What did they eat? To solve these questions Messrs. Heller, Cook, and Gilbert spent several weeks in camp at the foot of the towering cliffs that defend the Lost City. Writing of his observations, Mr. Heller says, in part:

"Birds in great variety and abundance flitted about our camp and through the neighboring forests. The Urubamba Valley acts as a highway or migratory route for birds between the highlands and the low country. I collected and noted some eighty species.

"Fly-catchers were the most numerous in species, the fifteen kinds which occurred here ranging in character from such familiar forms as our gray kingbird and black phœbe to small forest species of rich rufous tints.

"There was, in particular, a large, pugnacious cliff species and a peculiarly diminutive forest one with a remarkable voice, many times greater than the bird which uttered it.

"Our robin redbreast was represented by a drab brown species of equal size, which haunted the roadside and showed as much confidence in humanity as our bird. The Quichuas call him 'chi-wunk-koo', a name obviously derived from his call note.

"Swallows, resembling our tree-swallows in coloration, were common about the cliffs, while occasionally wandering flocks of a great swift whirled through the canyons.

"The finch family in Peru is a mere remnant compared to the wealth of species in our northern fauna. The tanagers, as a family, were the most abundant and gaudily colored birds with which we met.

"Humming-birds, usually very numerous in Peru, were here represented by only three species, one of them the most diminutive in South America. The size of a bumblebee, in flying it darted away in a straight line with great speed, quite indistinguishable from a bee.

"Another Peruvian bird familiar to the North American is the water ouzel, or dipper, a species of which was found here haunting the streams near rapids at the edge of pebbly bars, often wading thigh deep in the water or diving in shallow pools for insect larvæ. Its body is a rich seal brown and its head white.

"Among the birds of San Miguel there were no greater advertisers than the large green parrots, which passed overhead in small flocks, every member engaged with his fellows in an animated conversation of hoarse, discordant notes.

"Although we failed to get any bears near the ruins, we did trap a vile-smelling proboscis skunk, known to the Indians as the *amjas*. He dragged himself, trap and all, into a crevice between two rocks. After two shots, he seemed to relax his hold, and, assuming that he had been killed, I instructed my gun-bearer to pull him forth. When the skunk had been dragged into the daylight, we discovered our awful mistake, but too late!

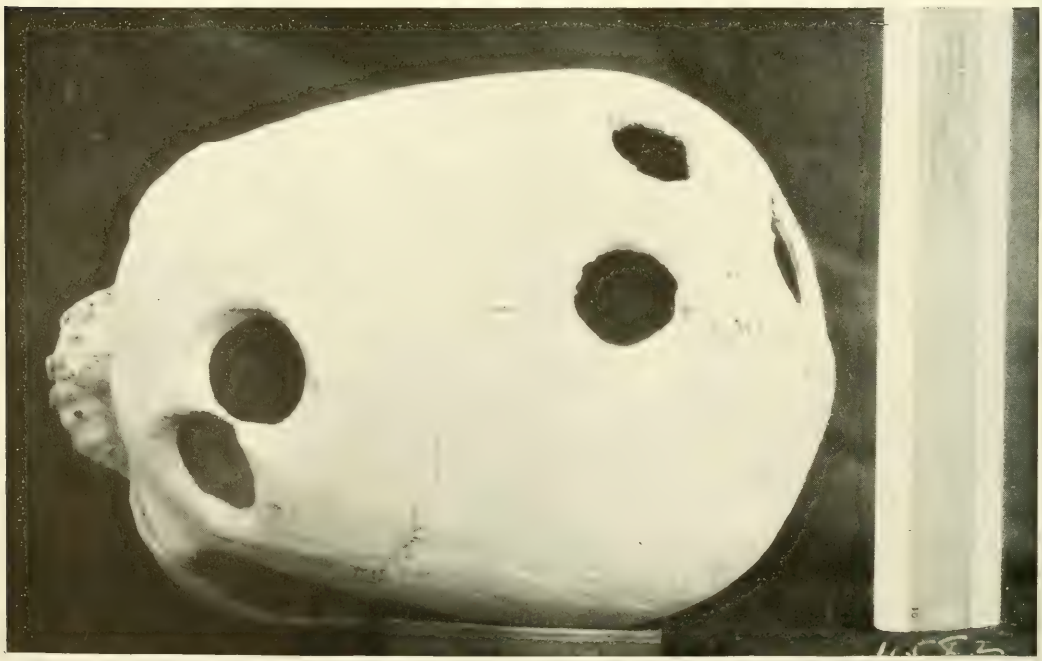
UGLY VAMPIRE BATS

"On the morning after our arrival at San Miguel Bridge the pack-mules nearly all showed blood blotches on their withers and backs, where they had been attacked during the night by vampire bats which had fed on their blood. This bat, *Desmodus rotundus,* is plentifully distributed throughout Peru in altitudes below 10,000 feet.

"It is one of the most highly specialized species of existing bats and is a member of the *Phyllostome* or leaf-nosed group. It has, however, lost its leaf nose to a large extent, owing to its abandonment of an insect diet. The lower jaw is

Photograph by D. E. Ford

MR. HASBROUCK AND THE SKULLS AND MUMMIES FOUND NEAR THE RUINS OF PAUCARCANCHA: NOTE TREPANNED SKULL ON BOX



Photograph by Hiram Bingham

THE MOST REMARKABLE TREPANNED SKULL YET FOUND IN PERU

Having five holes, the edges of which show evidence of healing. We are sure that this patient survived his operation (see page 455).

decidedly undershot, and the head, with its short, cropped ears and broad muzzle, has a strikingly bulldog appearance. The legs are well developed and rather heavy, enabling the animal to move fairly rapidly on the ground, in which situation it is by no means a shuffling, helpless creature like many other bats. If molested when thrown to the ground, it will turn and bite savagely.

"The teeth are a highly modified cutting apparatus for making incisions in the skins of mammals and birds. The cheek teeth, or grinders, have their crowns modified into narrow and high-cutting edges which work against their fellows of the opposite jaw much as the blades of scissors.

POWER TO EAT SOLID FOOD LOST

"Some four teeth only on each side take part in this cutting function, all the other molar teeth being suppressed or actually lost. Possessing teeth of a strictly cutting nature, this bat cannot crush insects, so that it is now actually forced to feed on the blood of other animals. Moreover, the gullet is so restricted or narrow that only blood can be passed through it, and the stomach is weak walled, with the general appearance of an intestinal structure. I have on several occasions examined the stomachs of these bats and have found them to contain only coagulated or clotted blood.

"In size the vampire is somewhat larger than our own common brown bat, compared with which it is a much heavier-built animal. The spread between the tips of the outstretched wings is eight or ten inches, and the length of the body from the tip of the snout to the insertion of the hind limbs is three and one-half inches. In habits they are sociable, and are commonly found living in caves or tunnels, suspended from the ceiling in clusters often of immense size.

"The animals usually attacked by the vampire bat are cattle, horses, mules, and donkeys. Their flight is low and close to the surface of the earth, and doubtless takes place late in the evening, when complete darkness has set in; so that they are, owing to such habits, seldom seen.

"Machu Picchu is locally notorious for the poisonous serpents inhabiting the region in which the ruins are situated. During the work of excavation by the 1912 Expedition several species of the dangerous viper commonly known as the *fer-de-lance,* or *bushmaster,* were encountered. During my trip to the ruins in October another smaller species of viper was secured on the trail. The local Indian guide informed me that during the summer he killed on an average one viper a week.

"The venom of the bushmaster is more powerful than that of any other viper in the New World and is slightly different in quality from that of the rattlesnake, to which it is allied in the general structure of its poison apparatus.

"A much more poisonous reptile, and one found in the same region, is the coral snake, which is armed with venom of the same character as the deadly cobras of Africa and India.

"The city of Machu Picchu is today, as regards its fauna, in much the same condition as during the days of its occupation by the Incas. The commonest birds about the terraces are the crested sparrow, black-headed grosbeak, the goldfinch, gray dove, and brown robin. Condors were seen quite often on the ridge."

The mammals of the ridge are forest types which still manage to live there under the changed conditions. As the city is surrounded by forests for many leagues, it has not been possible for highland mammals of the Andean grass region to reach the ridge by way of any grass-covered tongues or connecting spaces. The mammals known to occur within the limits of the city are the black forest opossum, the spectacled bear, the white-tailed deer, the proboscis-nosed skunk, the brown weasel, a large rodent the size of a woodchuck, a large arboreal or tree rat of the rice-rat group, a rat-like rodent, *Apodon,* and several other smaller rodents.

A WILDERNESS SUPREME

In August a party was organized to explore the so-called San Miguel Valley, which, although occupied for some time by rubber-gatherers, did not exist on any published map of Peru. The party consisted of Naturalist Heller, Topographer Maynard, and Surgeon Ford.

Photograph by Hiram Bingham

INDIANS DANCING IN THE OLD INCA PLAZA AT OLLANTAYTAMBO

This group was composed of six men dressed as usual, except that they wore black shoes, white stockings, colored paper streamers attached to their clothing, and hideous masks on their faces. Their dance, performed to music furnished by a flute and bass and snare drums, was a shuffle. At its close one of them pretended to be dead.

Photograph by Hiram Bingham

INDIANS ABOUT TO COMMENCE ANOTHER DANCE: OLLANTAYTAMBO

Photograph by Hiram Bingham

PART OF THE AUDIENCE THAT ENJOYED THE DANCING ON THE PLAZA AT OLLANTAYTAMBO

After ascending the steep northern slope of the Vilcabamba Valley, the trail continued from the summit down gentle, grassy slopes, encountering the forest again at 11,000 feet.

"From some of the forest openings," writes Naturalist Heller, "we obtained views of the great forest about us. It was a wilderness supreme, from which not even the thin columns of smoke of the camp-fires of savages could be seen. Nowhere else have I ever met with a region showing such little evidence of the presence of man. Finally, the road turned from the ridge and dropped down a steep grade for a league or more to the San Miguel River.

"The next day we came to the meeting point of the San Miguel and the Pampaconas. These two large streams form the Cosireni River, along which we continued to Yuveni."

"Our journey from Yuveni to the junction of the Cosireni with the Urubamba", write Messrs. Maynard and Ford, "took three days. The porters were rather a poor lot, full of malaria, and about two-thirds of them suffering from Oriental sore.

VICIOUS ANTS

"Two varieties of ants annoyed us considerably. The bite of the one—a small red ant—was not serious. One of our guides, bitten in the foot by the other species, suffered intense pain for a number of hours. Not only did his foot give him great pain, but also his leg and hip.

"On our trip three Indians spent one whole night fishing, and had one fish resembling a perch, and weighing about four pounds, to show for their work. All these Indians are inveterate coca chewers. Tobacco leaves are burned and the ashes placed in a gourd, where they are mixed with water until a pasty mass is formed. This mixture is dipped with a stick tipped with cotton, in much the same way that snuff is sometimes taken.

"Two beverages are made, one from yuccas and the other from honey. The first of these I saw being prepared and did not try it. The second, which is called 'milk of flies', I tried and found delicious. A large hairless caterpillar forms another article of the Indians' diet."

Naturalist Heller learned that the best hunting was to be found two days' march further on, in the valley of the Comberciato. Of his experience on this unexplored stream Mr. Heller writes, in part:

"In volume the river is twice that of the Cosireni. On its banks lived several families of Machiganga savages in small open huts. They gathered the rubber sap, which they traded for salt, knives, cloth, etc., as they have no conception of the use of coins and are quite out of touch with the Peruvian civilization of the highlands (see page 472).

MONKEY MEAT A FAVORITE DISH

"The men are keen hunters and fishermen. Their weapons consist of a black, ebony-like bow, made from the outer wood of one of the small, prickly-stemmed palms, and long reed arrows, which have the feathers at the base arranged in a spiral, so as to give a spiral twist to the projectile and greater accuracy to the weapon. Many are also armed with shot-guns, of an ancient, muzzle-loading type, with very long barrels and of small caliber. With these arms they hunt monkeys chiefly, of whose flesh they are very fond.

"Game birds of large size were abundant. In size and color the *tinamou* resembles the common guinea-hen. Its note was a clear, mellow whistle, one of the pleasantest and most characteristic sounds of the forest during the early morning, and again at dusk. Several species of large turkey-like birds, known as *curra-sows,* were often met. One of these was a heavy, glossy-black bird the size of our turkey, with a high, coral-red bill. On several occasions we saw it about the huts of the savages, thoroughly domesticated and at liberty.

"Parrots of many species were seen. Giant macaws were numerous and paroquettes abundant. A yellow-winged parrot, with remarkable ability as a linguist, was seen in a few localities.

"All of these species were seen domesticated or as pets about the huts of the Machigangas, who were very fond of the society of wild animals and showed

Photograph by E. A. Meserve

AN OPEN-AIR THRESHING FLOOR NEAR HUAROCONDO, PERU

The Biblical injunction against the muzzling of the ox used in treading out the grain on the threshing floor seems to be followed in the letter among the Indians of the Inca country. But their custom of hitching three or four oxen together with head yokes leaves them powerless to eat except under what is known in legislative parlance as "unanimous consent."

much affection for them. They were exceedingly gentle with their pets and were never seen to strike them or to show anger at any misbehavior on their part.

"Considerable hunting was done at night with a reflecting lantern of high power. These nocturnal rambles yielded specimens of red deer, several species of night-prowling carnivorous animals, opossums, and a peculiar night snake of the genus *boa*. The eyes of this snake were quite luminous and could be detected at a distance of 20 yards or more. The body was distinctly compressed, like that of a fish, instead of being circular in outline. The head was large and arrow-shaped, and armed with long teeth in the upper jaw, giving it a close resemblance to such poisonous snakes as vipers. The snake was light gray, resembling the bark of many forest trees; but on the back it was marked by large diamond blotches of a brown color.

"The largest specimen obtained, some 6½ feet long, was shot at 10 o'clock one night, hanging with its head within a foot of the ground and close to a small spring of water in the forest, which was a favorite resort for small mammals and other animals. This snake, after being rendered harmless by a shot in the head, coiled its body about the barrel of my shot-gun and exhibited such powers of constriction that it could scarcely be pulled loose again.

"Some 30 specimens of monkeys were collected, representing six different genera, with a single species to each. Besides the monkeys, two species of rare carnivorous mammals were obtained."

The complete zoölogical collection consists of 891 specimens of mammals, representing some 80 species, and 695 specimens of birds, representing some 400 species, besides several tanks filled with reptiles and batrachians. Of snakes there are some 15 or 20 species, of which 5 are vipers. There are 100 or 200 specimens of fishes, most of them of small size.

RICH IN FOODS

The botanists spent three weeks in the canyon near Machu Picchu and found the region particularly interesting, because it represented the border line between tropical crops and those of the temperate zone. The people of Machu Picchu, by going down the valley, could raise well-known tropical fruits like alligator pears, custard apples, guavas and papayas, and tree tomatoes. At the present time coffee, cocoa, bananas, sugar-cane, oranges, limes, and lemons can be grown in the valley not far below Machu Picchu. Whether any of these last-named vegetables were known to the Incas is very doubtful. On the other hand, they did grow in these tropical valleys cotton and coca, from which we derive the extract cocaine.

By going up the valley a few miles on the other side, such temperate-zone plants as potatoes in large variety, many kinds of Indian corn, and a considerable number of food plants that have not as yet been domesticated in the United States, could be grown in profusion.

Although Machu Picchu is thus shown to have been remarkably well situated strategically from the food point of view, the builders were greatly handicapped by the small amount of flat, arable land. As a result, they built terraces everywhere, and the extent to which they carried the construction of these small garden plots is even more extraordinary than we at first supposed it to be. Mr. Cook says in his report that "every spot where plants could be made to grow appears to have been utilized" (see the original paper by Professor Cook beginning on p. 474).

MODERN INDIANS OF THE LAND OF THE INCAS

Studies of the modern Indians, particularly in the Department of Cuzco, were made by Surgeon Ford and Chief Assistant Hardy. While Dr. Ford had to deal chiefly with Indians who came to consult him on account of their health, he made it a point to take measurements of as many subjects as were willing to submit to the "white man's medicine" of measuring-tape, calipers, and camera. Mr. Hardy gave his special attention to the general subject of the manners and customs of this region. Owing to the necessary limitation of space, I can only quote from a few paragraphs of their reports.

Photograph by Edmund Heller

THE MACHIGANGA INDIANS: PERU

These Indians gather rubber sap which they exchange for salt, knives, cloth, etc. They have no conception of the use of coins. Their weapons consist of bows and arrows and antiquated muzzle-loading shot-guns. They are very fond of monkey meat (see page 469).

"Anthropological measurements and observations were made by the Hrdlicka method. This necessitates approximately fifty notations and two photographs. Furthermore, it has the advantage of requiring but little removal of clothing and consequent exposure of person.

"As in former expeditions, the Quichuas were found to be very difficult to handle. They have an instinctive fear of the camera and a deep suspicion of the foreigner. Those living far from the main trails, who come little in contact with strangers, can seldom be persuaded to pose for portraits. They cannot be bribed or bought. They have little desire for money. They will not argue the question; simply turn their backs or run. There is a belief among them that the camera sees through their clothing and takes them in the nude.

"Along the more frequented lines of travel and in the small towns, especially after a few days of association, or by gaining their confidence through medical treatment, I could persuade many to pose for their portraits. Interest in their ailments and sympathy for their troubles would buy almost anything, from anthropological measurements to mule feed. By these methods and the occasional use of empty tin cans, cracker-boxes, and small silver coins, 153 Quichuas were measured—90 men and 63 women—and nearly as many photographed.

"The men were keen in the use of the dynamometer, the interpreter having explained that the one who put the needle the highest was the best man."

Southern Peru may be divided into three zones, based on altitude. These are: first, the highlands, the country devoted to grazing and potato-raising, 12,000 feet or more in altitude; second, the cereal belt, between 7,000 and 12,000 feet in altitude; and, third, the belt of tropical

agriculture, which is below 7,000 feet in altitude.

"The occupations of the highland Indian are stockherding and potato raising." Writes Mr. Hardy, "the stock belongs to the owner of the finca, but the Indian is allowed to pasture his own sheep and cattle with the rest. These are not many, although I found one Indian who claimed to own forty sheep, fifteen cows, and two pigs. He paid ten soles, or $4.80 gold, a year rental and had to work one week each year for the finca owner. They move as lack of pasture may demand, but always to some spot as wild and desolate as that from which they came.

AN HONEST RACE

"The Indians of the highlands have the purest blood and are much more attractive than those of the montaña or slopes. Bronze skinned, of medium height, but with huge chest expansion and wonderful leg development, some of the men of the highlands present a striking appearance. Those of the lowlands, although lighter in color, are generally more ill-favored and lack the ruggedness of feature possessed by those of purer blood. They are smaller, less healthy, and show more marks of dissipation. The pure-blooded women are rarely attractive, yet in Urubamba they are more attractive than the men and have more regular features. Practically all the natives have dark hair and eyes.

"In the uplands both men and women keep to their old styles of clothes, but as one goes down modern styles appear, until in the tropical belt the stiff, broad-brimmed hat and hand-woven poncho have disappeared entirely. Skirts get higher along with the altitude, until at some places they scarcely reach the knee, and give a decidedly fashionable effect.

"In the highlands the woman's hat closely resembles the man's (usually a bit smaller in circumference), but she never wears the woolen skull-cap. To match the poncho she has a *lliclla,* or shawl, the upper corners fastened in front with a silver pin or topo, usually possessing the shape of the bowl of a soup spoon.

"I found the Indians quite honest. Only two or three small articles were lost during the construction of our house at Yankihausi. It was the custom to pay their wages in advance, and we never met with very much disposition on their part to fail us.

"The Indians' only pleasures are beastly carousals. The children have no toys and are almost never engaged in play. As soon as they are able to walk they are set to work. They are early taught to collect firewood and forage wherever they can. Several times in Ollantaytambo I saw a little girl, who could not have been over three years old, driving home a sheep loaded with small branches which the child had collected for firewood."

The result of our four expeditions leads me to conclude that the Peruvian Indian is worth study and development. While it must be admitted that they seldom bathe and have some filthy habits, this is partly the result of living in the cold of the Andes and partly due to ignorance.

If the government of Peru would follow the example of the United States government in making it a crime to sell alcohol and cocaine to the Indians, its revenue would be greatly curtailed; but there is no question that ultimately the country and the Indians would both be far better off.

STAIRCASE FARMS OF THE ANCIENTS

Astounding Farming Skill of Ancient Peruvians, Who Were Among the Most Industrious and Highly Organized People in History

By O. F. Cook

Botanist of the National Geographic Society–Yale University Expedition to Peru in 1915, and of the Bureau of Plant Industry of the Department of Agriculture

AGRICULTURE is not a lost art, but must be reckoned as one of those that reached a high development in the remote past and afterward declined, and has not yet recovered its ancient prestige. The system of agriculture developed by the ancient Peruvians enabled them to support large populations in places where modern farmers would be helpless.

The most specialized development of agriculture in the Western Hemisphere was attained, unquestionably, in Peru, and the culmination was reached centuries ago, before Columbus discovered America. Still farther back there must have been a period of slow and gradual development—a period to be expressed in millenniums rather than in centuries. *At a time when our ancestors in northern Europe were still utter savages, clothed only in skins, and living by hunting and fishing, settled agricultural communities must have existed in the Peruvian region,* perhaps in the same valleys that contain the marvelous remnants of the prehistoric art.

The people who did the finest of the ancient work are not only gone and forgotten, but lack even the distinction of a name. Written records like those of Egypt and Assyria are lacking in Peru, and even tradition has failed to attach names of kings or nations to many of the ancient monuments. Some writers refer to the builders as Megalithic or Big-Stone people, because they used very large stones, like the fabled Cyclopes of the ancient Greeks, who built massive walls and worked in metals. Other writers refer to the ancient Peruvians simply as pre-Incas, because their work evidently belongs to an age farther back than the Inca empire conquered by the Spaniards.

As a race, it may be assumed that the Megalithic people were ancestors of the modern Quichuas, or at least of the same stock, for there is nothing to show that the human type was different in ancient times. In Peru, as in ancient Egypt, it was the custom to mummify the dead and to bury with the mummies the clothing, food, household utensils, weapons, and other objects and articles used by the living.

This regard of the ancients for their dead, together with the dry, equable climate, have made Peru a veritable treasure-house of archæological material. Not only the skeletons and the other physical features of the ancient people are known, but also the nature and degree of development of all of the arts that could be preserved by burial. The general result of such studies tends to show that the modern Quichuas, the Incas conquered by the Spaniards, and the pre-Inca or Megalithic people were all of the same race and practiced the same arts, including the art of agriculture.

The Incas had a very specialized agriculture, but their predecessors had some of the agricultural arts still more highly developed. They built larger terraces and faced them with larger stones, fitted with wonderful accuracy. The Incas also built extensively, but generally with less skill, or at least with less labor, bedding their stones and plastering their walls with clay, instead of taking the trouble to work down and fit together the huge irregular blocks that characterize the Megalithic period.

Like Egypt in the later dynasties, the Peruvians of the Inca age appear to have declined somewhat from the standard of industry, patience, and perfection indicated by the stone work of the earlier period. In other respects progress may have been made. Thus the Incas may have been better organized and more efficient from the standpoint of government and military activity, as were the Romans in comparison with the Greeks. The modern Quichuas are still an agricultural and pastoral people, but they show no tendency to imitate the constructive undertakings of their predecessors.

STAGES OF AGRICULTURAL PROGRESS

In order to appreciate the high development of the ancient agriculture of Peru, we have to consider briefly the stages that mark the progress of agriculture from the simplest beginnings to the most advanced expression of the art.

In the most primitive form of agriculture, still widely practiced in the tropics, the land is not permanently or continuously occupied. New clearings are made every season by cutting and burning. Corn is planted and harvested, and then the forest growth is allowed to spring up again. This nomadic system of annual cornfields, or *milpas,* as they are called in Central America, is practiced in all tropical countries of low elevation.

Tillage agriculture is the next stage. In order to use land for more than one season, tillage is necessary, at least to the extent of stirring the surface soil and destroying weeds, so that seeds can be planted.

A third stage is reached when tillage agriculture is improved by the application of manure, fish or seaweeds, or by using decayed vegetable matter or "green manure" to increase the fertility of the soil. Another step beyond tillage, with or without the use of fertilizers, is irrigation—the artificial application of water to the soil. Irrigation must have begun in regions where it was easy to supplement the natural rainfall by diverting streams, as in the steep mountain valleys of Peru.

Doubtless all of the preceding forms of agriculture were represented in Peru in ancient times, as they are at the present day; but they must have had relatively little importance in comparison with a type still more advanced—a type quite unknown to the American farmer and scarcely to be seen in the United States, except to a very slight extent in ornamental grounds. This most specialized type of agriculture includes all of the preceding features — tillage, fertilizing, and watering the crops; but another is added—the artificial construction of the soil on which the crops are grown. *In the valleys where the ancient Peruvian agriculture was centered, most of the agricultural land is not natural soil, but has been assembled and put in place artificially* (see also page 494).

MARVELOUS TERRACE AGRICULTURE

This most specialized type may be described as terrace agriculture, and is seen in its most conspicuous form when narrow terraces are built on steep slopes. Such terraces are found in many other countries, though it is doubtful whether any equal those of Peru. In Peru the artificial reconstruction of the soil surface was not limited to the terraced slopes, but was also undertaken in large areas of reclaimed land in the bottoms of the valleys. The courses of the rivers were narrowed and straightened by strong walls, and then the land behind the walls was filled in, and finally a surface layer of fine agricultural soil was put on.

The entire region that represents the chief center of the Inca empire and its Megalithic predecessors affords very little of the level or gently sloping natural soil that we would consider well suited to agriculture. Most of the level land is on the high plateaus, where the climate is too cold or too uncertain for the growth of crops, so that planting is confined largely to the slopes to avoid the danger of frosts in the growing season.

To us in the United States this laborious construction of the artificial lands in the warmer valleys seems almost incredible. Even irrigation agriculture appears to us as a new and very specialized branch of the art, and we think ourselves very enterprising to have undertaken the

reclamation of our so-called "deserts" in the Western States, where wide expanses of nearly level and very fertile soil have been made richly productive simply by being supplied with water. The native agriculture of Peru reached the stage of reclamation projects long before America was discovered by Europeans. *Our undertakings sink into insignificance in the face of what this "vanished" race accomplished.*

The narrow floors and steep walls of rocky valleys that would appear utterly worthless and hopeless to our engineers were transformed, literally made over, into fertile lands, and were the homes of teeming populations in the prehistoric days. That the work was well done there can be no possibility of doubt, for many thousands of acres of these artificial lands are still fertile and are the chief support of the modern population of the valleys. The native people take the amazing works of the ancients as a matter of course, as we accept the natural features that surround us, and are no more inclined than we are to such impossible undertakings as the ancient people accomplished.

That the ancient people should have taken to terrace-building is not difficult to understand in the presence of the natural conditions where the art developed. With an agricultural population becoming crowded in steep, rocky valleys, the removal and piling up of the stones to give more room for plants would be a most natural step for a primitive people to take. In the early days the building of terraces may have appeared simply as an effective way of disposing of the stones and leaving the largest area of tillable land after the work was done. If there were more stones than could be used in building the walls, the surplus could be disposed of by placing them behind the walls to form a porous subsoil for the surface layer of fine earth where the crops were grown. More land could be cleared by building the stones into walls than by merely throwing them into piles. The desirability of piling the stones or building the walls so that they would hold the soil in place and prevent washing would also become apparent.

The most strikingly artificial feature of the ancient Peruvian agriculture was the covering of steep slopes with narrow terraces, supported by stone walls and watered by aqueducts built for many miles along the precipitous slopes of the mountains. Some of the terraces, those that characterize the Megalithic Age of Peru, were built of enormous stones, often of very irregular form, fitted together with wonderful nicety.

The labor expended in the construction of these terraces shows that they served some purpose that the builders considered very important. We learn from the early Spanish historians that the Incas had special gardens for raising the potatoes of the royal household, and that there was a general belief among the people that the growth of crops and the fecundity of the flocks were acutely dependent upon the welfare of the royal family. Hence there was an underlying practical reason for the deep solicitude of the people, so often remarked by the early historians, "That it might be well with the Inca".

COMPARED TO THE HANGING GARDENS OF PERU, THOSE OF BABYLON WERE INSIGNIFICANT

The hanging gardens of Babylon have long been reckoned as one of the wonders of the Oriental world; and yet they were a mere transient toy and for 3,000 years have been only a tradition. The hanging gardens of Peru, though of unknown antiquity, are still in existence, and doubtless as worthy of our admiration as were those of Babylon in the days of Herodotus and Strabo.

The Babylonian gardens are said to have been 400 feet square and as high as the walls of the city, variously stated at from 75 to 300 feet. The structure had the form of a pyramid, with broad steps, on which earth was placed for the growth of plants. No doubt such an artificial hill was a striking object in the plain of Babylon, and gave Nebuchadnezzar's Median queen a pleasant reminder of her mountain home, where, it may be, there were valleys with terraced slopes as in Peru.

Many banks of terraces in Peru are very much longer and very much higher

Photograph by Hiram Bingham

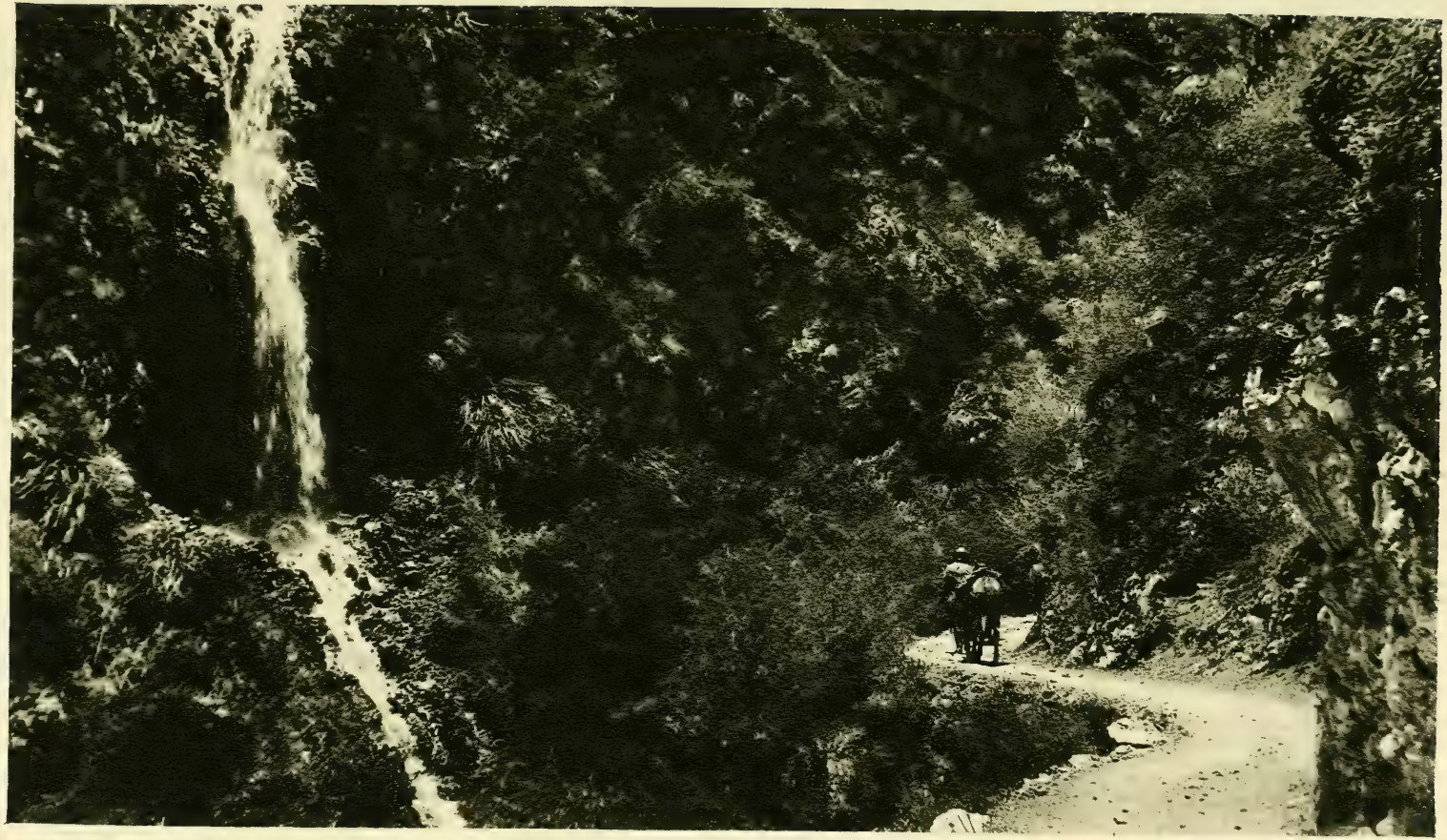
MT. VERONICA, 20,000 FEET HIGH, THE URUBAMBA RIVER, AND THE MAIN VALLEY ROAD

A portion of the pack train of the National Geographic Society-Yale University Peruvian Expedition of 1915 in the foreground.

Photograph by Hiram Bingham

THE GRAND CANYON OF THE APURIMAC

A bit of the Apurimac Valley between La Estrella and Abancay. If the Pan-American Railway is ever completed, one of the most interesting sections and one involving tremendous engineering difficulties will be in this immediate vicinity, where the road from Cuzco to Lima crosses this magnificent tributary of the Amazon.



Photograph by Hiram Bingham

AN ARTIFICIAL WATERFALL CONNECTING TWO ANCIENT IRRIGATION DITCHES IN THE HIGH COASTAL DESERT OF SOUTHWESTERN PERU

Numerous irrigation channels were carved along the steep mountain slopes, often for long distances. The courses of rivers were straightened, and many square miles of artificial land were constructed in the bottoms of the valleys with an expenditure of labor almost inconceivable.

Photograph by Hiram Bingham

THE NARROW RIDGE ON WHICH MACHU PICCHU IS SITUATED AND THE MAGNIFICENT URUBAMBA CANYON

A distant view of Machu Picchu on its narrow ridge, flanked by precipices, in the most inaccessible corner of the Andes, in the heart of the Urubamba Canyon. The sharp peak in the right foreground is Machu Picchu Mountain. The lower conical peak at the extreme left is Huayna Picchu. The city of Machu Picchu is on top of the ridge between these two peaks and almost directly underneath the little fleecy cloud which hides part of a distant mountain.

Photograph by Hiram Bingham

BIRD'S-EYE VIEW OF HUAYNA PICCHU MOUNTAIN AND MACHU PICCHU RUINS BEFORE MUCH CLEARING HAD BEEN DONE BY THE NATIONAL GEOGRAPHIC SOCIETY–YALE UNIVERSITY EXPEDITIONS

Situated on the top of the ridge at the foot of the hill called Huarua, protected on all sides by precipices and on three sides by the Urubamba River, Machu Picchu was ideally located for defense. The mountains in the distance form the side walls of the Grand Canyon of the Urubamba, often nearly a mile and a half deep.

Photograph by Hiram Bingham

THE SWITZERLAND OF PERU: A SCENE IN THE CENTRAL URUBAMBA VALLEY

The people of Pre-Columbian Peru had more than sixty species of plants under general cultivation, with half as many more under local cultivation. No other part of the Americas equaled this record. Peru was the chief center of plant domestication in the New World.

Photograph by H. L. Tucker

WHEAT AND BARLEY FIELDS ON THE SLOPES ABOVE THE URUBAMBA VALLEY

Across the middle of the picture runs one of the great highways of the region that has its center in the city of Cuzco.

The culture of the Incas may be said to have resulted largely from their success in domesticating the alpaca and the llama. They were domesticated so long ago that no wild members of the species remain. Using hundreds of thousands of beasts of burden capable of carrying from fifty to one hundred pounds apiece, the Incas were able to carry out their splendid engineering and agricultural work.

Photograph by Hiram Bingham

ONE OF THE HIGHEST AGRICULTURAL CANALS IN THE WORLD

The rich bottom lands of this elevated valley were desired by the Incas for growing potatoes. Accordingly, the meandering stream was straightened and enclosed so as to prevent it from occupying any more land than was absolutely necessary. It is in the upper valley of the Pampacahuana, a tributary of the Urubamba, and is at an elevation of 12,800 feet. Potatoes are still raised on the slopes of this valley at an elevation of slightly more than 13,000 feet.

Photograph by Hiram Bingham

AN UPLAND VALLEY EXPLORED BY THE NATIONAL GEOGRAPHIC SOCIETY–YALE UNIVERSITY EXPEDITION FOR THE FIRST TIME IN 1915

We are able to get a glimpse of life among the ancient Incas through the part of their vocabulary that has come down to us. They had different expressions to denote all the degrees of drunkenness, which shows that they had no prohibition; the absence of words for buying and selling shows that money was unknown; the fact that they had a single word to denote "enemy" and "soldiers" would indicate that they must have been "peace-at-any-price" people.

Photograph by Hiram Bingham

A ROADSIDE SCENE IN THE CENTRAL URUBAMBA VALLEY

The rim of this valley is from 6,000 to 10,000 feet above the river, and from 16,000 to 20,000 feet above the level of the sea. In these remote regions a llama can be bought for three dollars, a sheep for thirty cents, and a llama-load of firewood for twenty cents.

Photograph by Hiram Bingham

PLOWING TIME IN PERU

The sons and daughters of the Inca race may still survive, but their blood has outlasted their civilization.

Photograph by H. L. Tucker

A TYPICAL PERUVIAN PLAZA

The llamas are loaded with rock-salt. The open sewer in the center of the street is characteristic of most mountain towns.

Photograph by W. G. Erving

PLOWING IN THE CENTRAL ANDES

The plowman is a Peruvian mountain Indian. His oxen are descendants of the imported European stock; his plow is an iron tipped, pointed stick such as his ancestors have used since the Spanish Conquest. The scene is laid in the Urubamba Valley. The chief crop is Indian corn.

Photograph by Hiram Bingham

OUR CARAVAN CROSSING THE COASTAL DESERT AT AN ALTITUDE OF 15,000 FEET: MT. COROPUNA IN THE BACKGROUND, ELEVATION 21,703 FEET

Photograph by Hiram Bingham

A MULETEER'S STORE IN AN ARCADE ON THE GREAT PLAZA OF CUZCO

Here is exposed for sale everything that appeals to the eye and the pocketbook of the Peruvian muleteer. Richly decorated halters, leather knapsacks in which to carry his coca or other valuable articles, and even flutes to while away the weary hours of his journey are here displayed.

Photograph by Hiram Bingham

A BOY SHEPHERD AND HIS SHEEP: NEAR CHINCHEROS, PERU

As soon as they are able to walk the little Indian children of Peru are set to work. They are early taught to collect firewood and forage wherever they can. They have no toys and live a playless childhood. It is not an uncommon sight to see a little three-year-old girl driving home a sheep loaded with small branches which she herself has collected for firewood.

than the Babylonian wonder. A bank of 50 terraces 10 feet high means a vertical height of 500 feet. Many slopes have more than 50 terraces, forming huge staircases as high as the Washington Monument, resting against the lower slopes of mountains that tower for thousands of feet above. It is only by taking the ancient works out of their natural setting that we can appreciate their gigantic proportions.

AN AMAZING SPECTACLE

In the days when they were built, the hanging gardens of Peru must have presented an amazing spectacle. All of the terraced valleys, with their teeming populations, were probably as clean of trees and shrubby vegetation as some of the valleys still are, where people have continued to be too numerous to permit of reforestation. Thus the terraces must have stood out in much greater prominence than they do now, when most of them are abandoned and overgrown with grass and bushes. In some of the valleys in the vicinity of Ollantaytambo reforestation is well advanced and the terraces now support large trees.

THEIR MEMORIALS TO THE GREAT WERE AGRICULTURAL TERRACES INSTEAD OF TOMBS

The building of terraces was developed into a fine art in Peru. *The skilled labor that was lavished in ancient Egypt on the tombs of the sovereigns appears to have been applied in Peru to the construction of gardens of special workmanship for raising the food of the royal family.* The ancient Peruvians made burial structures for the mummies of their dead, but the chief concern was for the living. The tombs were of modest proportions and were placed in caves or set high on the rocky cliffs in the mountains, not in locations suitable for agricultural purposes.

Pressure of population afforded, no doubt, the underlying compulsion to go forward with the construction of the agricultural terraces, and at the same time tended to develop skill and emulation. The natural interest in the permanence of one's work, the desire to do it well, and the wish to have it appear to advantage, doubtless were motives that spurred the ambition of the prehistoric masons, as of artists of the present day. The terraces are beautiful, not only because the stones are finely dressed and nicely fitted, but because the work is fully in keeping with its surroundings and admirably adapted to its purpose. The function of a terrace wall is to stand and hold the soil. Thousands of the ancient terraces have stood through the centuries, and the soil that the ancient people laid down is still in place.

The work that the prehistoric builders accomplished is still beyond our comprehension. Nobody has explained how it was done or how it could be done. Indeed, the modern Indians deny that it ever was done, preferring to believe that it was the work of enchantment. Huge rocks that could have been moved only with the greatest difficulty and by the combined labor of hundreds of people are nevertheless fitted together with incredible nicety. To say that there are seams too fine to insert knife-edges or tissue papers leaves the story only partly told. There is no room for inserting anything, since the surfaces are actually in contact.

With some of the finest work, at Ollantaytambo, the joints are in many places too fine to be seen by the naked eye. A lens becomes necessary to make sure that there is really a seam and not merely a superficial groove, or false joint. Professor Bingham compares the fitting of the stones to the grinding of glass stoppers into bottles, which is the best analogy thus far suggested. But how can anybody credit the idea of grinding together with such accuracy the edges of stones that weigh tons? Obviously the edges must have been ground before the stones were put in place. But the grinding in itself does not seem so difficult to explain as the shaping of the stones with such accuracy that the ground edges fit so absolutely together.

THEIR MASTERPIECES WERE GARDENS INSTEAD OF FORTRESSES

That the masterpieces of the Megalithic art have been described hitherto as fortresses instead of as gardens only shows how far our own race is from appreciat-

ing the devotion of the ancient people to their agricultural pursuits. From the nature of their undertakings it is plain that in those days agriculture had the highest consideration. Nothing that human labor could accomplish was too much of an honor to be paid to the art that enabled these ancient people to create for themselves the essentials of a civilized existence, even under very unfavorable natural conditions. Notwithstanding the enormous labor expended upon the building of ordinary terraces, such work was carried far beyond the practical necessities and brought to a stage of perfection that compels us to wonder as well as to admire.

In some respects even the finest of the walls appear very rude, but for that very reason they bear the more overwhelming testimony to the remarkable perseverance of the builders. In what other way could a primitive people have left so convincing a testimony of their attainment of the condition of an ordered society? The people who carried through these undertakings had not only solved the problem of existence and of food supply, but had developed very high standards of artistic perfection, along with the energy and patience to carry them into execution under natural conditions of extreme difficulty and with none but the simplest of tools.

The development of terrace-building into a fine art would follow naturally after the terrace system of agriculture came to be widely used. No people capable of such perseverance in the building of terraces would fail to take pride in their walls, as masons have done ever since. From the very foundation of Rome we have the tradition that Romulus killed Remus in a quarrel over the construction of a wall.

In Peru the building of walls for terraces came in advance of walls for houses or towns, and we may believe that the builders of the finest terraces received the highest appreciation. Building the terraces in more difficult places and making them of harder and larger stones, joined with greater and greater skill, would be natural steps in the development of the art, like the larger and larger pyramids of the successive Egyptian pharaohs. Indeed, when all the conditions are taken into account, it is difficult to imagine any other kind of work in which skill would be so likely to be developed and applied as in the building of these terraces.

THE STRUCTURE OF THE TERRACES

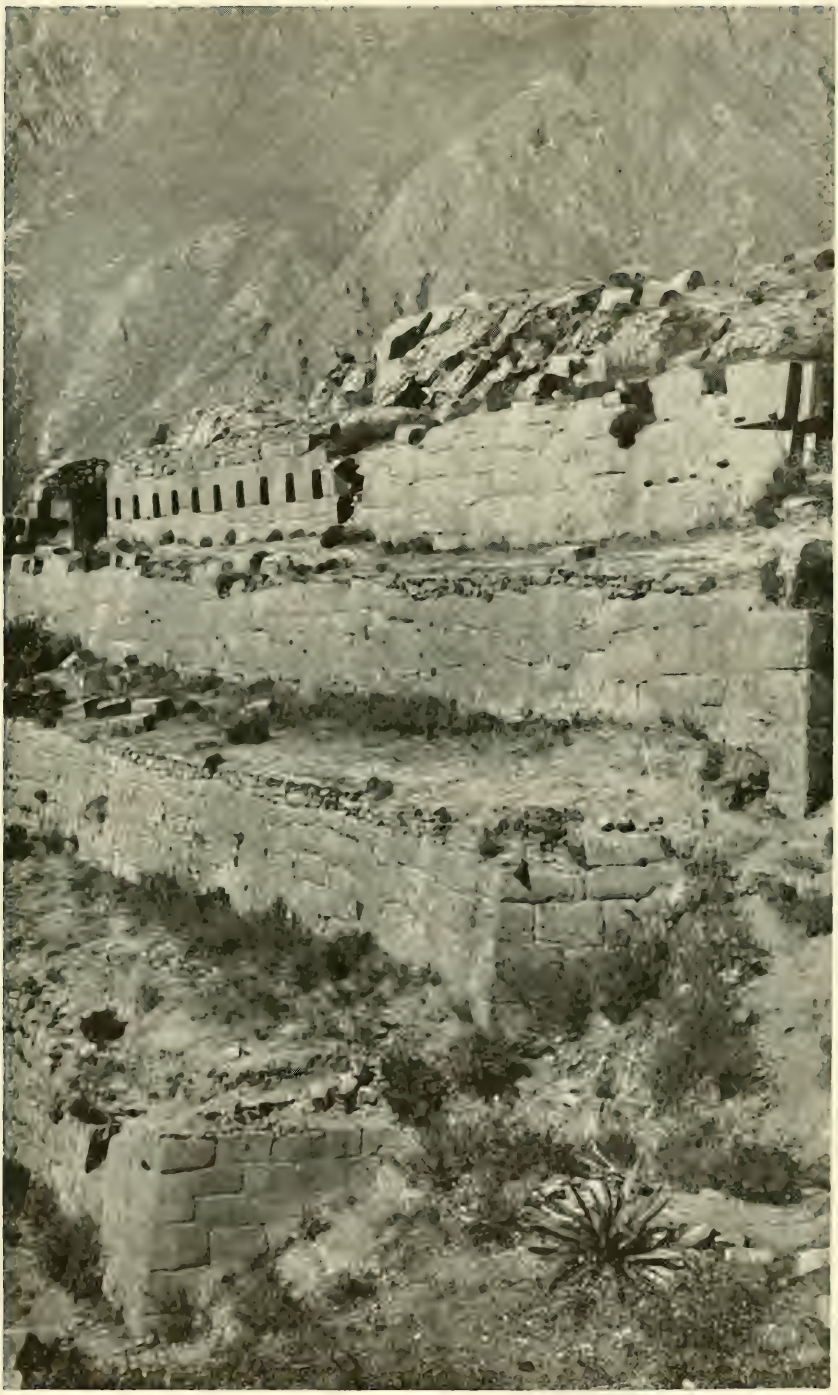
That the terraces, including those of the finest construction, were built for agricultural purposes is obvious as soon as their internal construction is taken into account. Each terrace consists, roughly speaking, of three parts—the wall and the two distinct layers of earth that fill the space behind the wall. *All of the ruined terraces show the same inside structure, wherever the walls are removed.* The strata that are hidden behind the walls are artificial no less than the stone facing (see page 509).

The underlying stratum, or artificial subsoil, is composed of coarse stones and clay, and is covered by a layer of fine surface soil two or three feet thick. The thickness of the subsoil layer depends, of course, upon the height of the terrace. Where clay or other light-colored material is used for the subsoil, the difference between the two layers appears most striking; but the finer texture of the upper layer also renders it very distinct (see page 508).

In height the terraces range usually from 8 to 14 feet, the width depending upon the slope. Terraces on very steep slopes or narrow shelves of rock are sometimes only 3 or 4 feet wide, though the usual range is from 8 to 15 feet, or still wider on the more gradual slopes. Banks of 20 to 30 terraces are not uncommon, while 50 or more are found in many cases.

That some of the stones and soil for building the terraces was carried by llamas is not impossible, but does not seem very probable. Most of the terraces are at elevations below 11,000 feet, while llamas are used chiefly in the higher altitudes. Probably most of the soil was moved in baskets or mats carried on men's backs.

There is a tradition that earth for the Inca garden at Cuzco was brought from a special place near Quito, some 700 miles



Photograph by O. F. Cook

A FEW OF THE FINEST MEGALITHIC TERRACES OF THE HANGING GARDENS OF OLLANTAYTAMBO

Some of the stones have been torn away near the corners of the terraces, and the upper layer of fine agricultural soil is partly exposed. The row of niches in the upper terrace may have corresponded to a row of windows in an outer wall, thus inclosing a long passage or corridor, with a doorway at either end, of which one remains (see page 438).

away. This may be taken at least as an indication that soil was carried sometimes for long distances, and in such cases it probably was transported on pack animals.

THE WATERING OF THE TERRACES

Water was brought to the terraces from the slopes above in artificial channels or acequias leading down, often for many miles, from the gorges of the high mountains, where they intercepted perennial streams fed by the melting of the glaciers and snow-fields (see page 504). Careful provision was made to avoid erosion of the soil or injury to the walls.

Three different methods of bringing the water down from one terrace to another are to be seen about Ollantaytambo. Some terraces have narrow vertical channels near the ends of the retaining walls. In other banks of terraces the water was brought down over large upright stones and caught in a basin below.

The third method was to carry the water down along the walls at the ends of the terraces, which were set with double rows of stones to form the water channel between.

Long banks of terraces are interrupted at intervals by passageways that doubtless served the double purpose of roads for reaching the terraces and of drainage channels to bring down surface water from the slopes above, and thus avoid the danger of having the terraces washed away by heavy rains.

The handling of the water on the terraces undoubtedly was greatly facilitated by the fact that the soils in all the terraced districts are extremely tenacious and not readily eroded. A few sods or a small ridge of earth will hold in check a stream of water, even with a swift current.

THEY PROBABLY HAD SHOWER-BATHS

A special feature in terrace watering was indicated at Machu Picchu, where many large stones, deeply grooved lengthwise, lie scattered along the terraces. Such stones might have served as spouts to carry the water out from the terrace wall, and thus avoid still further the danger of erosion or undermining of the wall.

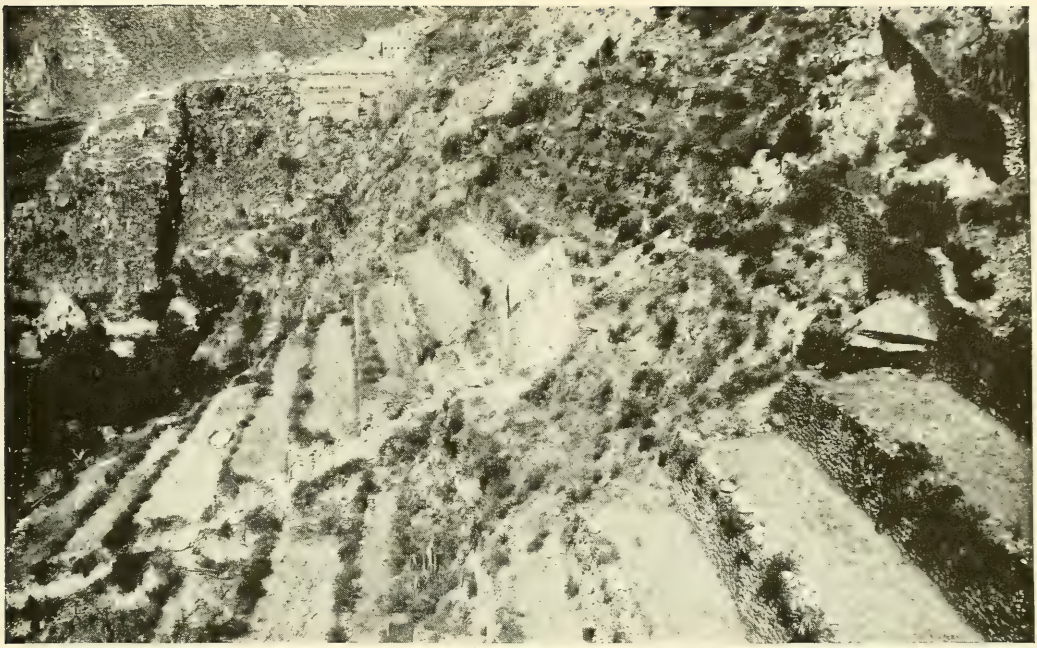
The idea of hanging gardens watered by small streams or jets falling through the air affords an attractive possibility in the existence of the ancient people. Conducting the water down over the terraces in this way would afford ample shower-bath facilities for the people who worked on the terraces. Let us at least cherish the hope that the so-called "baths" found in the ruins of Machu Picchu and elsewhere were not merely basins where water was dipped up in jars, and that the ancient people were not as deficient in ideas of bodily cleanliness as their modern descendants. Ethnologists are familiar with the fact that the introduction of European clothes has tended in many countries to destroy habits of cleanliness among primitive peoples.

A LAND-STARVED PEOPLE ACCOMPLISH THE INCREDIBLE

Some of the most laborious terracing is not on the steep slopes, where the terraces are high-walled and narrow, but in the bottoms of the valleys, where the terraces are often very broad. The building of broad terraces required more labor because it involved the filling and leveling of much larger areas behind the walls. Much of the work could have been avoided by making larger numbers of lower and narrower terraces, but the walls would have been more numerous and would have occupied more of the surface.

With labor very abundant and land very scarce, the ancient engineers followed the plan of making the terraces as broad as possible, sometimes even to the extent of bringing material and filling in behind walls 15 or 20 feet high. Thus it would be very conservative to estimate that the building of the broad, valley-bottom terraces involved the handling and replacing of the earth for an average depth of at least 6 feet over the entire surface. This allows 3 feet for the surface layer of fine soil and at least an equal depth for the subsoil layer.

The labor would depend, of course, on how far the material had to be carried. Some of it may have been moved only a few feet, some a few yards or rods, but some must have been brought for considerable distances, as when areas of cul-



Photograph by O. F. Cook

SOME OF THE STAIRCASE FARMS OF THE ANCIENTS

Each terrace consists of three parts—the wall and the two distinct layers of earth that fill the space behind the wall. *All of the ruined terraces show the same inside structure, wherever the walls are removed.* The strata that are hidden behind the walls are artificial no less than the stone facing (see also illustrations, pages 508 and 509).

The underlying stratum, or artificial subsoil, is composed of coarse stones and clay, and is covered by a layer of fine surface soil two or three feet thick. The thickness of the subsoil layer depends, of course, upon the height of the terrace. Where clay or other light-colored material is used for the subsoil, the difference between the two layers appears most striking; but the finer texture of the upper layer also renders it very distinct. The lower terraces of this bank are still under cultivation. In the background a part of the megalithic terraces can be seen. A ruined Inca house stands near the base of the precipice at the left.

tivated lands were widened by building new terraces along the beds of the streams.

In many cases the work was evidently planned so that large immovable boulders or outcrops of rock could be utilized in the building of the walls instead of being allowed to diminish the area of cultivated land. We may believe that powder or dynamite, to shatter refractory rocks, would have been very highly appreciated among the ancient Peruvians.

STRAIGHTENING OF RIVER BANKS AND STREAM BEDS

It would be a mistake to suppose that reclamation work in the bottoms of the valleys was wholly or even principally of the nature of improving irregular land by terracing and leveling behind the walls. A large part of the surface of the valley bottoms must have been altogether bare of soil, as the unimproved portions still are—mere wastes of loose stones brought down by the torrential floods.

The natural behavior of swift mountain streams is to cut irregular channels back and forth between the walls of their valleys, but in the terraced valleys of Peru it is the regular condition to find the rivers and smaller streams confined to channels of definite width, and sometimes kept in straight courses for several miles at a stretch, as in the case of the Urubamba River near Pisac, and again below Ollantaytambo. In the latter instance the river runs for nearly five miles in a straight course, and, although the ancient walls that were built to confine the river have remained intact in only a few places, the artificial nature of the channel is obvious.

A road that runs along the river has utilized the top of a buried wall as a pavement. These buried walls, which occur also in other places, make it evident that narrowing of the channel of the river was accomplished by gradual stages. In this case the area of cultivated land was widened for about 12 feet toward the river by building a new wall closer to the river and filling in behind it. The old wall was left in place, but buried in the mass of the terrace and covered with earth so that it did not interfere with the cultivation of the land. Thus the land-starved people gained an additional strip of land, only a few feet wide, but several miles long. The river may have furnished the stones for the new wall, but the layer of surface soil must have been brought from a distance.

THESE ANCIENT PERUVIANS BUILT AQUEDUCTS THAT ARE UNEQUALED ELSEWHERE

The ancient aqueducts of Peru have challenged the most attention from former travelers, and they do not become less worthy of admiration because they are now seen to be only one feature of a highly specialized agricultural system. The construction of the irrigation channels was an enormous undertaking, perhaps not equaled in any other part of the world. From the aqueducts alone it is evident that agriculture must have attained a high development, which may explain why the other branches of the art have received less consideration.

How numerous and extensive the ancient aqueducts really were may never be known, but the subject is worthy of much more extensive study than it has received thus far. If the accounts of early Spanish writers are to be accepted, some of these aqueducts were very long. Garcilasso wrote of one of them as 55 leagues long and another 120 leagues, with a depth of 12 feet.

Where the soil was loose the channels were paved with stones for many miles. On rocky slopes or precipices channels were cut into the cliffs, and in some cases tunnels of considerable length are said to have been drilled.

Where channels were being carried along the sides of steep slopes, the usual method of passing vertical surfaces or overhanging rocks was to build up a wall from below to the height of the channel. In sheltered angles such walls remain in place after the channels that ran along the exposed slopes have entirely disappeared.

WHERE SQUASHES ARE TIED

The favorite courses for the ancient irrigation channels, and by far the best from an engineering point of view, were along the very crests of the ridges and spurs of the mountains. In such places the water-courses were cut, and now have worn deep grooves. Thus there is no danger of the channels washing away or being filled up by drainage from above, as with channels that run along the slopes (see page 517).

Cultivation was by no means confined to the walled terraces that usually follow the lower slopes of the mountains, but was carried all the way up, on any slopes that were not too steep to permit the accumulation of soil. It was not necessary to build terraces to get rid of rocks on slopes that are so steep that rocks roll off. Slopes are even now cultivated where squashes have to be staked or tied to keep them from rolling down the mountain, and where potatoes must be picked instead of being shaken from the vines. As these higher slopes are cool and cloudy, there is much less need of irrigation than in the valleys below.

Though stone terraces were seldom built on the high slopes, a system of narrow earth terraces or transverse ridges, somewhat analogous to the contour farming in our Southeastern States, was in general use. Remains of such ridges cover large areas of the higher slopes. Usually there are a few large ridges at intervals, with numerous smaller ridges between. Many of these smaller ridges can be seen from the valleys below only when the light comes from a particular angle, so as to cast shadows across them. When lighted from in front the inequalities are not shown, and nobody would suspect that such steep slopes, now producing only a sparse and scattered

Photograph by O. F. Cook

TERRACES ON NARROW SHELVES

In addition to the terraces of regular form built in banks, any irregular shelf of rock that would support a wall was likely to be used as an agricultural terrace. In this case the shelves were so narrow that the terraces could have been only three or four feet wide—hardly room enough for more than one row of potatoes.

growth of bunch grass, were once cultivated (see illustration, page 511).

In one place just below Urcos a narrow strip between broken precipitous rocks is covered with short transverse ridges like a stairway.

The areas that have been farmed in this way are very extensive, much more so than the lands that are still cultivated in the valleys below. A few of these high slopes are still cultivated, but most of them have been abandoned. Where the lands are now used by the Indians, the same system of transverse ridges is employed. The larger ridges at intervals have the effect of preventing, or at least impeding, erosion. These ridges are not cultivated, but are left in grass, and thus serve to let the water run down the slopes without allowing it to cut channels, thereby having the function of spillways or "drops" in irrigation systems.

EVEN THE GLACIERS RETREATED BEFORE THEIR INDUSTRY

Riding for many hours, or even for days, through valleys where all of the upper slopes show signs of having been cultivated in former times, and very few are cultivated now, eventually gives one an almost oppressive feeling of the past that has vanished long since, and yet is so ever-present that the eye can scarcely avoid it, even when one looks up to the glaciers and the eternal snows. The people who grew potatoes on the high slopes must have stood in their day against the same icy background. Indeed, their agricultural activities may have driven the very glaciers back, by gradually clearing the mountain slopes and exposing them to the sun, just as they narrowed and straightened the river torrents by hemming them in with successive walls of rock.

That the glaciers formerly extended much farther down is shown by the positions of the moraines. There can be little doubt that the whole aspect of the country has been altered profoundly during the very long period of intensive agricultural occupation. Biologically speaking, there is every reason to believe that most of the cultivated lands had a forest covering originally, and that the present state of denudation is largely artificial. Remnants of a native forest flora are still to be found in places too rocky and broken to be cultivated, even by the strenuous methods of the ancients.*

A RECLAMATION AGRICULTURE

From the facts already stated, it is apparent that the ancient agriculture of the interior valleys of Peru was to a very large extent a reclamation agriculture—that is, an agriculture involving community organization and planning in advance. Only a very small part of the land that was used was naturally adapted to the raising of crops. Much of it was too dry to grow crops without irrigation, and even more of it was so steep or so rocky that the surface had to be terraced or otherwise reformed in order to make it suitable for cultivation.

Of the four forms of reclamation that were so extensively employed in ancient Peru not one has been used, or even seriously considered, in the United States. Nowhere do we cultivate steep lands like the higher slopes of the Peruvian valleys, or build stone walls to support narrow terraces, or place artificial soil on broad terraces in valley bottoms. In a few places we are beginning to straighten and confine our rivers to make more land along the banks, but chiefly with the object of preventing floods or reclaiming broad, level lands by drainage, not with the idea of building new lands in the rocky beds of torrents, as in Peru.

COÖPERATION FOR THE COMMON GOOD

Primitive the ancient Peruvians were in many ways, as their modern Quichua descendants still are; but with respect to agriculture and some of the attendant arts a very high state of development must have been attained and at a remote period. Otherwise it would have been impossible to occupy and reclaim many of the places that evidently were centers of population in ancient times.

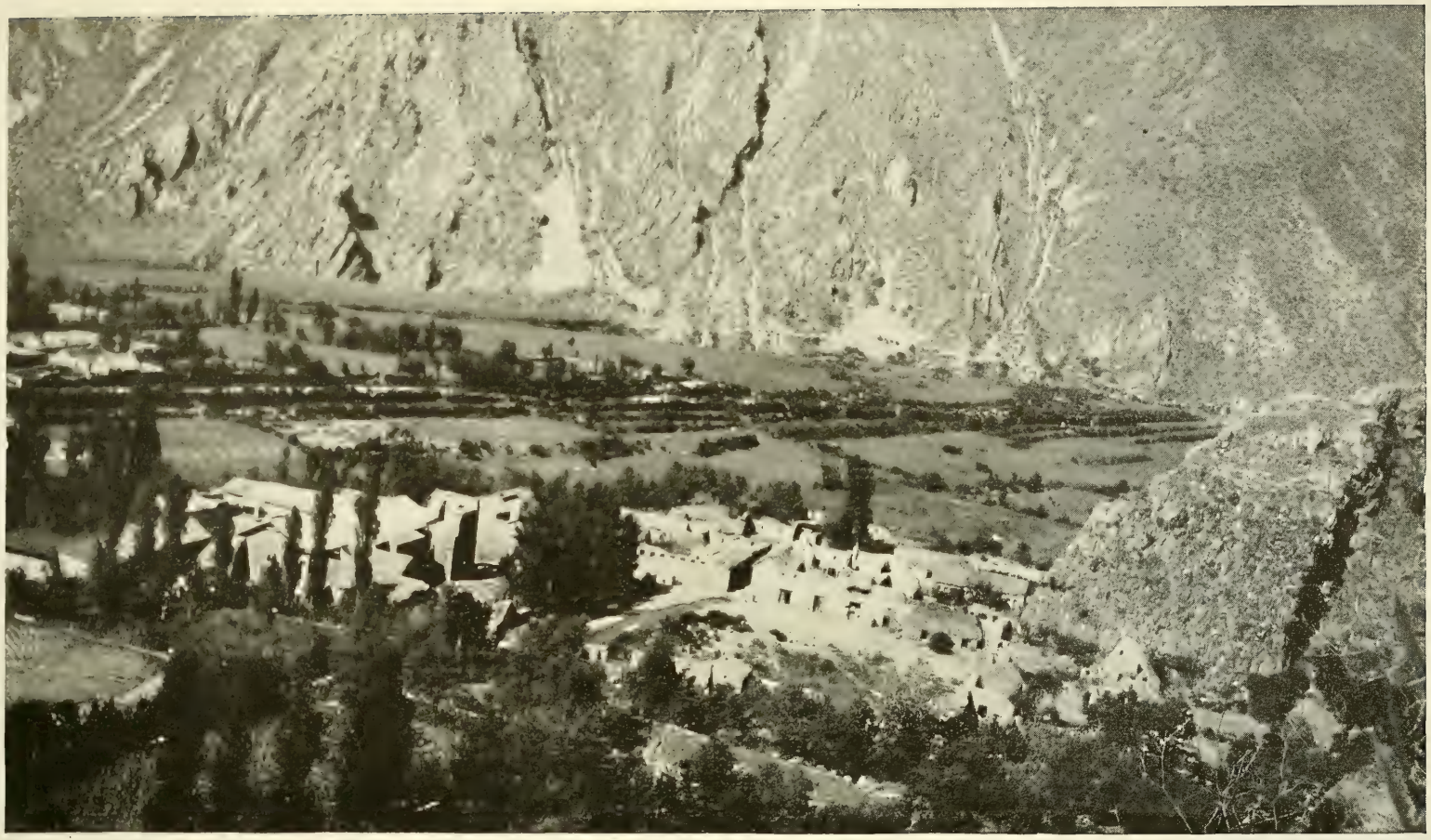
Many localities must have been treated as reclamation projects from the very

*For a more detailed treatment of these matters, see "Agriculture and Native Vegetation in Peru". Journal of the Washington Academy of Sciences, Vol. VI, pp. 284-293.

Photograph by O. F. Cook

WHERE THE CROPS OF THE INCAS WERE STORED

Storehouses represent a very specialized branch of Inca architecture. A long, narrow building, with one wall much higher than the other and a curious half-gable roof tied to projecting stones, typifies this kind of structure. The width of these storehouses inside the walls is usually less than eight feet, and many of them are built in small sections, which are nearly square. The one shown in this photograph was about 28 feet long and 25 feet high. The walls are about 30 inches thick, of stones laid in clay and stuccoed with clay mixed with grass. The unusual height of the building, the arrangement of the windows, and the lack of any indication of an upper floor argue against its use for human habitation. It is far more likely that this type of house was built for the specific purpose of a granary or storehouse.



Photograph by O. F. Cook

TERRACED VALLEY BOTTOM AT OLLANTAYTAMBO

All the open fields are broad, artificial terraces. A large aqueduct or causeway, about a mile long, carried on walls 15 to 30 feet high, seen in the middle of the picture, crosses the valley in a nearly straight line. A part of the town is seen in this view from the northern bank of elevated terraces or hanging gardens. In the lower right-hand corner is the end of the projecting ridge that carries the hanging gardens. The town is surrounded on three sides by large agricultural terraces (see pages 438 and 440). The valley at this point is about a mile broad and overhung by steep mountains about a mile high. Several banks of terraces, their true size dwarfed by the mountain above, can be made out along the base of the rocky slope. This view is from the slope above the hanging gardens.

first. They could not have been occupied in any desultory way by colonists or settlers acting separately as individuals. This is plain from the natural conditions and from the nature of the work that had to be done before the crops could be grown to support the colonists.

In many places the aqueducts afford the only permanent supplies of water for human uses as well as for the irrigation of crops. Deliberate planning is also shown in the placing of the aqueducts and terraces, and in the regular way in which the lands of the ancient reclamation enterprises were laid out. Large areas appear to have been developed as units, on the basis of carefully considered undertakings. If the valleys had been settled first by unorganized individuals, at liberty to take lands where they liked, the most favorable places, where the lands were nearly level, would have been occupied first. The tendency would have been to pile up the stones around the boundaries of the fields, which would take the form of irregular circles or fans, like those that occur in some localities.

An excellent example of the results that naturally would follow from a desultory occupation was observed in the Urubamba Valley, near Calca, in a district where crops can be grown without irrigation. The contrasting conditions are represented by the district around Ollantaytambo, where evidences of regular planning are encountered on every hand. The regular planning of the ancient Peruvian cities has been remarked by Wiener, who gives the plan of Ollantaytambo as an example; but the regularity in the laying out of the lands and irrigation works affords still better evidence that the plan was made before the district was occupied. A town site might be changed or reorganized by a powerful chief, but it would be more difficult to believe that all of the agricultural lands would have been readjusted if they had been occupied at first in a desultory manner. In the Peruvian system *the agricultural structures are more permanent than the dwellings.*

In relation to agriculture the results of archeological research in the two hemispheres present a striking contrast. In the Eastern Hemisphere the general result is to show that the civilizations supposed to be the most ancient are not really primitive or aboriginal. They did not have their beginnings and early development in Egypt or Mesopotamia, but were brought from elsewhere. The early dynastic Egyptians came into the Nile Valley from the East and the early Babylonians into the valley of the Euphrates from the South. Nor does it appear that either of these alluvial valleys afforded natural conditions that were really favorable to the practice of agriculture by a very primitive people, nor types of plants suited to domestication.

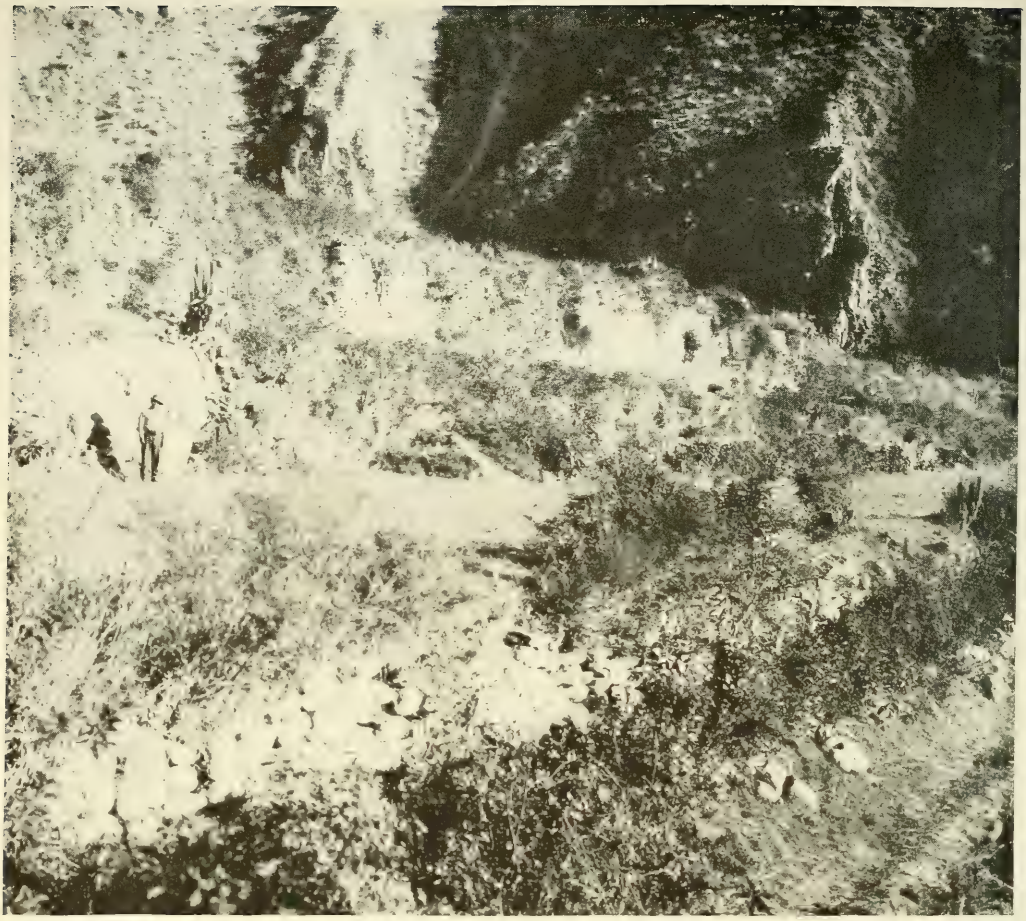
A MOST INTERESTING COMPARISON

The crop plants as well as the ancient agriculturists came into the valleys as a result of colonization. In other words, the valleys were developed as reclamation projects by peoples already skilled in agricultural arts and with an established social organization.

Where these civilized colonists came from is still a question. They are supposed to have come into Egypt and Mesopotamia from southern Arabia and to have been a maritime people, as well as agricultural; but they have not been traced back to their original home or to the place where their agriculture and other arts were developed.

The study of agriculture in America has led to directly opposite results. The older idea that the primitive civilizations of Mexico and Peru were originated by colonists from China, the Malay region, or the East Indies has gradually given way to a belief among archæologists and ethnologists that the primitive civilizations of America were developed entirely on the American continent. Certainly this appears to be true of the art of agriculture. All of the economic plants on which the ancient American agriculture was based are now believed to be of American origin, and a very large proportion of them appear to have come from South America, and especially from the region of Peru.

Of course, it would not follow that agriculture might not have originated in other places as well as in Peru. All that



Photograph by O. F. Cook

ANCIENT AQUEDUCT AND TERRACES

A portion of the long walls crossing the Urubamba Valley at Ollantaytambo, shown in the general view on page 502

can be said now is that the indications of such a center of origin and domestication of plants in other parts of the world are less definite than in the region of Peru.

It may be that the deep, narrow valleys of Peru imposed conditions necessary to the development of agriculture, at least in its very early stages. The difficulties of communication would mean that each valley must have had its own group of people, separate from all of the others, and that each of these independent communities was restricted to a narrow range, with only a limited stock of natural products to draw upon, and hence under pressure to learn how to increase the growth of the useful plants and destroy their useless competitors.

Whatever the motive or the pressure that led to the development of agriculture under such conditions, of the fact there can be no doubt. That the system of agriculture did develop here is proved by the fact that the plants on which the agriculture was based were indigenous, and that no such system existed in other parts of America.

YOU CAN LOOK FROM THE EQUATOR TO THE POLES

Agriculture in Peru is a matter of altitude. Geographically you are in the tropics, but agriculturally you may be anywhere between the Equator and the northern limit of agriculture, at the Arctic Circle. Moreover, you can find this

Photograph by O. F. Cook

A TERRACED VALLEY ABOVE OLLANTAYTAMBO

The terracing of this narrow valley is amazing. Parts of it are shown in several photographs that follow (pages 506 to 518). The high slopes at the left were also cultivated in former times. At the base of the steep mountain on the right is a large slide of loose stones, several hundred feet high. All this flat valley is artificial—that is, it was a gully—and would so have remained if the Peruvians had not broadened it and leveled it out (see text, page 496).

range of conditions, not by going to different parts of the country, but in different parts of the same valley, in places within plain sight of each other. Thus from among the plantations of sugar, coca, or cacao, at Santa Ana one can see at the other end of the valley some of the peaks of the Cordillera, covered with glaciers and perpetual snow. It is like looking from Jamaica to Alaska. Even on foot or on mule-back only a few hours are required to climb up or to descend through the full range of agricultural possibilities.

No very definite division into agricultural belts is possible. Some crops are confined to the high altitudes and others to the low, but there is endless overlapping with the intermediate crops. Three agricultural belts can be distinguished on the basis of the principal food plants. The cultivation of cassava, called *yuca* in Spanish and *rumu* in Quichua, may be allowed to characterize the lowest or tropical belt, which extends in the Urubamba Valley to an altitude of about 6,000 feet. From this altitude to about 11,000 feet is the intermediate belt, with maize as the principal native crop, while in the Andine belt, above 11,000 feet, the potato is the most important food plant.

In some districts wheat is grown rather extensively and is often the chief crop at altitudes between 10,000 and 12,000 feet. Barley and broad beans (*habas*) are two other European crops that are planted on a relatively large scale at high elevations. Above 12,000 feet the people are engaged chiefly with the grazing of herds of llamas, alpacas, cattle, and sheep; but potatoes and other Andine crops are planted on a small scale for the support of the pastoral population. In most places agriculture does not go much above 13,000 feet, but on some of the slopes above the Pass of La Raya potatoes are planted at altitudes above 14,000 feet. The vines make normal development and produce abundantly when planted in good soil.

Even among people of intelligence and interest in agricultural problems the superficial fact that Peru lies within the tropical zone is commonly allowed to obscure the relation of its agriculture to that of temperate regions. The fact is, of course, that in spite of the proximity

Photograph by O. F. Cook

A RECLAMATION PROJECT MADE IN PERU WHEN THE EUROPEANS PROBABLY LIVED IN CAVES

Immediately below Ollantaytambo are these broad terraces, covering more than a square mile. The soil in these terraces was assembled and put in place as carefully as for the terraces shown on page 497 (see text, page 496). The land produces a crop every year and probably has done so for centuries. In the background along the slope at the left may be seen an inclined road, where the ancient people dragged up the enormous stones to the top of the ridge above the hanging gardens shown in previous photographs.

to the Equator large areas of the plateau regions of Peru have not merely temperate climates, but conditions that could be more correctly described as cold temperate, subarctic, or alpine.

THE LESSON OF THE POTATO

In spite of having come from intertropical South America, the potato does not endure heat, but thrives at the extreme limit of agriculture in the Northern Hemisphere—Norway, Finland, Siberia, Alaska, and Newfoundland. Likewise in the Southern Hemisphere the potato was carried, even in pre-Spanish times, to the cold coast belt of Peru and Chili, and has since been taken to South Africa, Tasmania, and New Zealand (see also pages 510 and 513).

The wide utilization of the potato has proved strikingly that a plant able to grow on the high plateaus of Peru may be adapted to any of the coldest regions where agriculture is practiced in other parts of the globe, and indicates that the other domesticated plants of Peru may also be useful to all the temperate and subarctic regions of the world.

MORE PLANTS WERE DOMESTICATED IN PERU THAN IN ANY OTHER PART OF THE WORLD

It was fortunate for the rest of the world that the ancient Peruvians practiced agriculture under so wide a range of natural conditions, since this led to the domestication of a large series of crop plants. More plants appear to have been domesticated in the Peruvian region than in any other part of America. A large proportion of the cultivated species were limited to this part of the world, so that no question can be raised of their having been brought from other regions. Other kinds of crop plants used by the ancient Peruvians were widely distributed in ancient America, more especially the tropical species, those that are grown at low elevations. If these also originated in Peru, that region was responsible for by far the larger part of the American series of crop plants, more than all other parts of America taken together.

Among the more important crop plants that were cultivated by the ancient Peruvians were maize, or Indian corn, potato, sweet potato, and cassava. The following partial list of the Peruvian crop plants may give an idea of the extent and variety of domestications that were accomplished in Peru:

Achupalla (pineapple), *añu* (Tropæolum), *apichu* (sweet potato), *apincoya* (granadilla), *arracacha* (Arracacia), *chirimoya, chui* (bean), *coca* (Erythroxylum), *cumara* (sweet potato), *inchis* (peanut), *oca* (Oxalis), *pallar* (Lima bean), *papa* (potato), *papaya, poro* (bottle-gourd), *purutu* (frejol), *quinoa* (Chenopodium), *rocoto* (Capsicum), *rumu* (Manihot), *sahuinto* (guava), *sara* (maize), *tintin* (Tacsonia), *tomate* (Lycopersicum and Cyphomandra), *tumbo* (Tacsonia), *ullucu* (Ullucus), *uncucha* (Xanthosoma), *utcu* (cotton).

VARIETIES OF PERUVIAN CORN

A complete list of the plants that were cultivated by the ancient Peruvians has yet to be made, but it will probably include between 70 and 80 species. A large part are root crops, vegetables, and fruits, but some are seed crops, pot herbs, condiments, medicinal plants, dyes, and ornamentals. Annual plants predominate in numbers and importance, but perennials, shrubs, and trees are also well represented.

Maize, or Indian corn, is a remarkable plant, botanically as well as agriculturally. It is entirely unlike any other crop and has very few relatives in the plant world. The early explorers found corn in general cultivation in all of the agricultural areas of North and South America, but no wild form has been discovered. Where maize originated is still a question. Some writers have favored Mexico and others Peru. The relative importance of maize was greater, no doubt, in Mexico, where not so many other plants were cultivated as in Peru. Another reason for associating maize with Mexico is the occurrence of the grass called teosinte, which crosses readily with maize and was formerly believed to represent the ancestral form.

That the cultivation of corn goes very far back in Peru is indicated not only by the abundance of specimens found in the

Photograph by O. F. Cook

A CROSS-SECTION OF A TERRACE

This part of a ruined terrace shows how the gardens were constructed. At this point the retaining wall had been carried away, except a little at the lower left-hand corner, thus exposing the material behind the wall and allowing its arrangement to be seen. Two distinct strata are apparent, coarse stones and clay below, with fine agricultural soil above.

ancient graves, but by the fact that the type of maize that furnishes the bulk of the Peruvian crop is peculiar to that region. The question is not merely of varieties, which are very numerous in both continents, but of a whole series of varieties very unlike any that are known from Central America or Mexico.

This Peruvian maize, or Cuzco corn, as it has been called in the United States, is characterized by the very large kernels, some of them nearly an inch broad, almost the size of chestnuts. The large kernels are an advantage from the standpoint of the natives of Peru, who are accustomed to eating corn a kernel at a time. The usual method of cooking corn, and everything else in Peru, is by boiling, the reason being probably that more fuel would be required for roasting or parching. Fuel is very scarce and expensive in all of the populous districts of Peru.

PERUVIAN CORN MAY HELP US

In the United States the large kernels would be of less importance, but the Peruvian type of maize may prove interesting in another way. The fact that the Cuzco corn is the only type grown extensively on the high slopes and tablelands may mean that it is more suited to cool climates than other sorts of maize. The large kernels have attracted the attention of travelers, and numerous attempts have been made to introduce the Cuzco corn into the United States. Bayard Taylor raised a few plants in Pennsylvania as far back as 1865 from seeds brought home by Squier, the well-known writer on Peru.* Such experiments with the Cuzco corn in the United States have given a completely misleading impression regarding the habits of the plant.

The usual behavior of the Cuzco corn in the United States is to produce plants of enormous size that mature very little seed, often none at all. It has been taken for granted that the size of the plants should be in proportion to the enormous kernels, and that our seasons were not long enough to permit this type of corn to mature.

But in Peru one does not see these gigantic, infertile plants, nor any indication that the corn crop requires a large amount of heat to bring it to maturity. The impression one gets from the Peruvian corn-fields is that the plants are not taller than with us and rather more slender, the most striking peculiarity being the prevailing red color of the foliage. The best development and largest ears of the Cuzco corn are found in some of the higher valleys, at elevations between 9,000 and 11,000 feet, in districts where the summer climate is cooler than in any of the corn-growing regions of the United States.

Thus it becomes apparent that the possibility of utilizing the Cuzco type of corn in the United States is still practically un-

**American Agriculturist*, 40: 9, January, 1881.

Photograph by O. F. Cook

ANOTHER ILLUSTRATION TO SHOW THAT THE SOIL AND SUBSOIL OF THE TERRACES WERE PLACED AS LABORIOUSLY AND CAREFULLY AS THE WALL ITSELF

The structure of a large agricultural terrace exposed along the stream near the middle of the valley, seen in the photograph on page 506, shows that these broad terraces are as truly artificial as the narrow ones on the slopes. A part of the old retaining wall that protected the terrace from the stream is still in place at the right, while the naked bank at the left has the same arrangement of fine soil above and loose stones for subsoil as the narrow terraces of the hanging gardens (see text, page 496).

tried, because of our lack of information regarding the normal behavior of the plant and the natural conditions to which it is adapted. As might have been expected, if these facts had been known, the best results thus far obtained from the Cuzco corn in the United States have been in California, in the cool climate of the coast districts, where there is too little heat for our eastern varieties to thrive.

Thus the first step in determining the possibilities of acclimatizing and adapting South American varieties of corn to use in the United States is to place them under conditions where the plants can behave in a normal manner and mature seed. In experiments conducted last year near the coast of southern California all of the varieties from Peru and other table-land regions of tropical America were able to mature seeds, which many of them had failed to do when planted in the Eastern and Southern States.

A CORN THAT GROWS AT AN ELEVATION OF 13,000 FEET

The cultivation of corn in a cool climate has been pushed to an extreme limit on the high plateaus around Lake Titicaca, where a dwarf form of corn is planted at an elevation of nearly 13,000 feet. The specialized nature of this variety became apparent in the experiments near San Diego, where it matured in less time than any other, or in about 60 days. Worthless as it would appear from the insignificant nubbins that we purchased from the Indian women in the market of Copacabana (page 523), this dwarf table-land form is distinctly of interest as an example of a variety with much lower heat requirements than those we now

have, which shows a possibility of extending the range of the corn crop in the United States.

In the tropical portions of the lower valleys of the eastern Andes the Cuzco type of maize gives place to another with larger ears and smaller kernels, much more similar to the Mexican and Central American varieties, or to those that are cultivated in the United States. If maize originated in the Peruvian region, it would be easy to understand that the varieties grown at the lower elevations would be much more likely to spread to North America than the varieties that are confined to the cool table-lands.

The existence of the specialized high altitude types of maize in Peru may be taken to indicate either a very long period of adaptation to the high altitudes or a possible origin of maize as a high-altitude plant. Whether the course of adaptation has been upward or downward, the success of the process is very significant of the possibilities of much wider utilization of maize in cool regions than has been considered possible in the past.

Maize is not a staple crop at very high altitudes. Above 12,000 feet it is raised in only a few places, not as a regular food, but rather as a luxury for making the native beer, or *chicha*. To take the place of maize, the natives of the elevated districts use plants that are closely related to one of our common weeds, called "pigweed" or "lamb's-quarters."

PIGWEEDS FOR OATMEAL

Two species of pigweeds are regularly grown in the valleys that lead up to the Pass of La Raya, between Cuzco and Lake Titicaca. The large species, which often attains a height of 3 or 4 feet, is called *quinoa*, while the small species, seldom more than a foot high and often only 5 or 6 inches, is called *cañihua*. In general appearance both species are much like our pigweed, but they are regularly planted and harvested by the Peruvians, and are in fact the only seed crops grown in the elevated districts that are too cold for maize.

Considering *quinoa* as a high-altitude substitute for maize means that it is valued chiefly for making beer, and in some districts most of the crop is used in this way. Only the white-seeded variety of *quinoa* is considered suitable for eating, the others being very bitter, so that they have to be boiled, with several changes of water, in order to be made palatable. The white *quinoa* makes an excellent breakfast food, fairly comparable with oatmeal, and likely to be preferred by many, both for the taste and texture. The seeds become soft with cooking, but retain their form, and do not appear so slimy as oatmeal when treated in a similar manner. The leaves of *quinoa* are also cooked and eaten as a pot-herb.

The other pigweed crop, *cañihua*, is raised altogether for food. The seeds are much smaller than those of *quinoa* and of a grayish color in the mass. They are parched slightly and ground into a fine flour. The chief use of *cañihua* is as a travel ration for the shepherds who go out on the high plateaus with their flocks of llamas, alpacas, and sheep.

THE TREASURE OF THE INCAS

The gold of the Indies was the attraction that led Columbus to sail westward, that carried Cortez to Mexico and Pizarro to Peru. The Incas had large stores of the precious metal, representing, no doubt, the accumulations of many centuries. The capture of such a booty resounded through Europe. Spain became for a time the wealthiest, as well as the most powerful, nation of Europe, and this was ascribed to the gold of Peru.

But Peru held another treasure much more valuable for the nations of Europe than the golden booty of Pizarro. Carrying the potato to Europe was an event of much more profound significance in relation to the subsequent history of the world than sending the Inca gold to the coffers of Spain. But nobody understood the value of the potato, and its Peruvian origin was generally forgotten before the plant became well known. Instead of Peruvian potatoes, we call them Irish potatoes.

The potato was the basis of the ancient Peruvian nation and has attained almost the same importance in other parts of the world within the last hundred years.

Photograph by O. F. Cook

TERRACES REACHING ALMOST TO THE SNOW

Not only the terraces, but all of the higher slopes, appear to have raised crops in ancient times, and cultivation continues in a few places that can be distinguished near the top of the ridge. The broken slope near the middle of the photograph is on the side of a deep ravine filled with a dense forest, which is spreading gradually over the neighboring slopes (see page 500).

Photograph by O. F. Cook

THE URUBAMBA RIVER OPPOSITE OLLANTAYTAMBO

An ancient retaining wall still protects a bank of terraces along the base of the steep southern slope of the valley. The terraces are overgrown with tara trees (*Cæsalpinia pectinata*), pinco pinco (*Ephedra*), chuchao (*Fourcroya*), and several species of cacti.

The instinctive prejudice against new food plants prevented any general utilization of the potato in Europe for over two centuries, and it did not begin to be grown as a crop until the period of the French Revolution. Even then it had to be forced on the public by the persistent efforts of the French philanthropist, Parmentier, who demonstrated its food possibilities by establishing a large number of soup kitchens for the poor of Paris. Potato soup still bears the name Parmentier—a homely memorial, but one that might not be ungrateful to a philanthropist.

Historically speaking, the general utilization of the potato is still relatively recent. Less than a century ago it was still considered as something of a novelty among the farmers of the United States. Thus, in 1856, we find in the *American Agriculturist* the following statement:

"I have worked a farm over fifty years, and have cultivated potatoes more or less every year. Fifty years ago little was thought of this root. A row or two were planted on the outside of corn-fields, or in some corner of a lot unfit for anything else. Ten to fifteen bushels was an ample supply for a family. There is a great difference between then and now as regards this crop, for potatoes are now one of the most important branches of agriculture" (Vol. 15, p. 256).

Contrast with this statement the fact that about 400,000,000 bushels of potatoes are produced annually in the United States. The world's crop of potatoes must be more than 6,000,000,000 bushels. The statistics of production for 1912 showed 5,931,493,000 bushels, but included no returns for the ancient centers of production in the table-land regions of Peru, Bolivia, Ecuador, Colombia, and Venezuela, nor for Central America or Mexico. As the potato-growing districts are the chief centers of population in all these countries, many millions of bushels must be produced by them.

The world total of six billion bushels means that if the potato crop of the world were to be divided equally, there would be enough to give each inhabitant of the earth about four bushels of potatoes. *The value of a single potato crop probably much exceeds that of all the gold that the conquerors took from the Incas.*

THE HOME OF THE POTATO CAN GIVE US OTHER VALUABLE FOODS

As the home of the potato, Peru may be looked upon as the source or fountain head from which must come new stocks to strengthen and maintain the varieties of this great food staple. Just as continued importation of live-stock breeds is necessary to renew our American strains, it is now beginning to be urged that new and vigorous varieties of potatoes be found to offset the gradually waning virility of old and run-out stocks.

Other possibilities lie in the direction of securing varieties that are really superior to any that we now have. Notwithstanding the enormous importance that has been attained by the potato in the agriculture of Europe and the United States, no adequate attempt has been made to secure the best forms for our use.

Peru has many kinds of potatoes superior in quality to those that we cultivate, but most of them would not be considered promising with us, because the tubers would be hard to peel on account of irregular form and very deep eyes (page 524). Breeders of potato varieties have been influenced very largely by the size and form of the tubers, with quality and flavor left largely out of account. But, with such an infinity of forms to draw upon in South America, it should be possible to combine all of the desirable features. Some of the Peruvian varieties are almost ideal in form (page 524).

It seems very strange, in view of the importance attained by the potato, that there should not have been a more general appreciation of this and the other plant treasures that South America has bestowed upon the other continents. Not only the Peruvian varieties of potatoes, but many of the agricultural plants of Peru, are still entirely unknown in other countries. Much less has there been any systematic effort to gain what might be described as an agricultural cognizance of these treasures — that is, a practical knowledge of the nature, habits, and uses

Photograph by O. F. Cook

FARMING AT AN ANGLE OF 45 DEGREES

A slope in the valley of Ollantaytambo, with an angle of about 45 degrees, or steeper than the roofs of most houses, is covered with transverse ridges, showing that the entire surface was cultivated in former times. Parts of the same slope farther to the left are still cultivated. The structures in the foreground are ancient graves or storehouses, perched on a large rock, seen from a ruined town called Pumamarca.

of the plants. Of some of them even botanical information is lacking. Indeed, it may be said that knowledge of some of these plants has actually declined since the time of the conquest.

The account of Peruvian economic plants written by Padre Cobo less than 70 years after the conquest is still the most extensive and detailed work on the subject.

OTHER PERUVIAN ROOT CROPS

The agriculture of Peru is based on root crops, primarily. Seed crops are relatively few, and, with the exception of corn, are almost incidental to the numerous root crops. Even corn is used largely for making *chicha* rather than for food, especially in many districts at higher elevations, where potatoes are the chief article of diet.

In order to understand the domestication of many root crops in Peru, it is necessary to go back to a pre-agricultural or an extremely primitive agricultural state, when people subsisted entirely or very largely upon wild roots, and resorted every year to the gathering of these, instead of being able to rely entirely upon the products of cultivated land, as in a more advanced state of agricultural development. With agriculture developed to the point of complete independence of the wild-food materials, no more domestications of food plants are likely to be made, as none seem to have been made during the entire historical period of civilized European agriculture.

From eating a great number of plants, as the wandering savages do, agricultural man gradually becomes restricted by habit to the foods that are produced by cultivation, and he finally reaches a stage where the idea of going out and bringing in a wild plant to cultivate as food is entirely foreign to the mind. To the present-day Indians of Peru the cultivated food plants represent a perfectly distinct and definite class. The plants that are sown are sown, and the plants that are wild are wild. They accept as a matter of course that there are wild potatoes, wild ocas, wild añus, wild arracachas, wild achiras, and so on down the list; but it is not supposed that these have anything to do with the cultivated forms of the same types, or that anybody would be foolish enough to plant the wild kinds and expect to raise crops from them.

If any more plants are domesticated in Peru, the Indians are not likely to do it—that is, for their own use. If some new crop should be introduced by the white people, or if a demand should arise for the product of a wild plant that could be cultivated easily, the Indians might go to planting it, for their agricultural habits and instincts are highly developed; but either of these contingencies is very different from a spontaneous domestication of a new native food plant on their own initiative and for their own use.

In the alpine or Andine belt, where the potato is the chief crop, three other root crops are generally grown, by the same methods and often in the same rows with the potatoes. These Andine root crops are the oca (*Oxalis tuberosa*), the añu (*Tropæolum tuberosum,* page 526), and the ullucu (*Ullucus tuberosus*). The tubers of all of these plants are remarkably alike and similar to some of the varieties of potatoes, although the plants have no relation to potatoes or to each other. The *oca* is a relative of our sheep sorrel, the *añu* of the common flowering nasturtium, and the *ullucu* of the Madeira vine. Though not attaining the size of large potatoes, the other tubers are more attractive in appearance and seem to have even better keeping qualities.

The possibility of utilizing them in the cooler parts of the United States is worthy of careful consideration. Their value might lie, as in Peru, in supplementing the potato, and thus affording a more varied vegetable diet. They yield well and are easily grown. Though natives of a tropical country, these crops are found only in the cool elevated districts and are, like the potato, intolerant of high temperatures.

In the lower part of the potato belt there is another root crop—the *yacon* or *llacon* (*Polymnia sonchifolia*)—comparable to the so-called "Jerusalem" artichoke, which is supposed to be a native of Mexico. It produces large, compact clusters of thick, fleshy roots tapering at both ends and with a strong external re-

semblance to sweet potatoes. The flesh is crisp, juicy, and has a pleasant, sweetish flavor, rather better than that of the Jerusalem artichoke. The *yacon* and *ajipa* (*Cacara*) are eaten raw, while all other root crops are cooked.

At elevations below 6,000 feet another series of root crops is grown, consisting of numerous varieties of *rumu* (Manihot), *uncucha* (Xanthosoma), *apichu* and *cumara* (two types of sweet potatoes), *achira* (Canna), and *unguna* (Curcuma).

THE HARVESTING, STORAGE, AND DISPOSITION OF THE CROPS WERE DIRECTED BY THE GOVERNMENT

According to the early Spanish historians, the Incas had complete control of the land and of all of the agricultural activities of the people, from the planting of the seed to the harvesting, storage, and disposition of the crops. An extensive system of public storehouses was maintained, not only at the chief centers of population, but along all of the principal routes of travel and in the high passes between the valleys.

A complete system of accounts was kept by means of *quipus*, or knotted cords, with different kinds and colors of knots to represent different quantities and classes of objects. The system of public accounting was used not only to determine the taxes or contributions to the government, but as a practical form of insurance, a failure or deficiency of crops in one section being made good from other parts of the country, where more abundant harvests had been secured. When the country was devastated at the time of the Spanish conquest the same system of making good the local losses was employed, "in order that all might not be devastated," as we learn from the account of Cieza de Leon,* written probably about 1550:

"So it was arranged, and as soon as the Spaniards were gone the chiefs assembled, the *quipus* were examined and checked, and if one province had lost more than another, that which had suffered less made up the difference; so that the burden was shared equally by all. To this day these accounts are kept in each valley, and there are always as many accountants as there are lords, and every four months the accounts are made up and balanced."

In like manner it is apparent from the accounts of the early historians that the recognized object of the religious system was to secure favorable conditions for the growth of the crops. Like many other primitive peoples, the Incas had a system of sacrifices or offerings to secure the favor of the gods. Though not a cruel or bloodthirsty people like the Aztecs, whose sanguinary deities required a continual butchery of captives, there is no longer any doubt that the Incas also had a system of human sacrifices to secure the favor of the deity for the Inca and his people. A special religious caste of vestals or Virgins of the Sun was maintained at some of the chief religious centers, and numerous burials of strangled women have been reported by Uhle at the great temple of Pachacamac, near the coast south of Lima. The object of these sacrifices, as stated in a passage quoted by Uhle from Molina, was "that the Creator might grant the Inca victory, health, and peace."

How thoroughly ingrained and instinctive the Inca system was may be best understood from the extent to which it still persists, nearly four centuries after the conquest. The need of "paying the Incas," in order to be assured of good crops and natural increase of the flocks, is still felt by thousands of the rural Indians and manifested in many ways. In the native markets of all of the larger towns there is an extensive trade in medicinal and aromatic plants, the chief use of which is for burnt offerings to the Incas to avoid the risk of offending them and thus inviting injury or loss.

Other curious survivals of the ancient system are seen in the little images of metal, clay, or stone which are buried in the ground for the benefit of the crops. At Cuzco minute images are made of metal, but at La Paz the same purpose is served by carved stones, called *mullo*

* Cieza de Leon, Pedro de. Second part, Chronicle of Peru, translated by Clements R. Markham, London, 1883, pages 34-35, Hakluyt Ed.

Photograph by O. F. Cook

THE COURSE OF AN ANCIENT AQUEDUCT

The indistinct dark line that crosses the high slope, shown about two inches below the top of the photograph, represents the course of an ancient aqueduct carried for many miles along a mountain wall hundreds of feet above the valley. In the foreground, near the ruined town of Pumamarca, is a group of Inca storehouses. The stream in the bottom of the valley is carried in a straight course along the farther side of the valley bottom. Note canals cutting across mountains (see text, page 498).

Photograph by O. F. Cook

ARTIFICIAL LANDS ALONG THE URUBAMBA RIVER BELOW PISAC

For about a mile the river has been confined by walls to a straight channel and the land leveled to the base of the slope where narrower terraces were built, the first two with broad, sweeping curves (see page 497).

or *piedras de Charasani.* These are still used and sold regularly in the native markets by the dealers in medicines and aromatic drugs. These curious sculptures take the form of small models of fields and farmsteads, with rows of sheep and cattle. They remind one of the colonnades of bulls in Egypt, which may have been constructed for the benefit of the animal industry of the Empire of the Pharaohs.

Photograph by O. F. Cook

INSURING AGRICULTURAL PROSPERITY

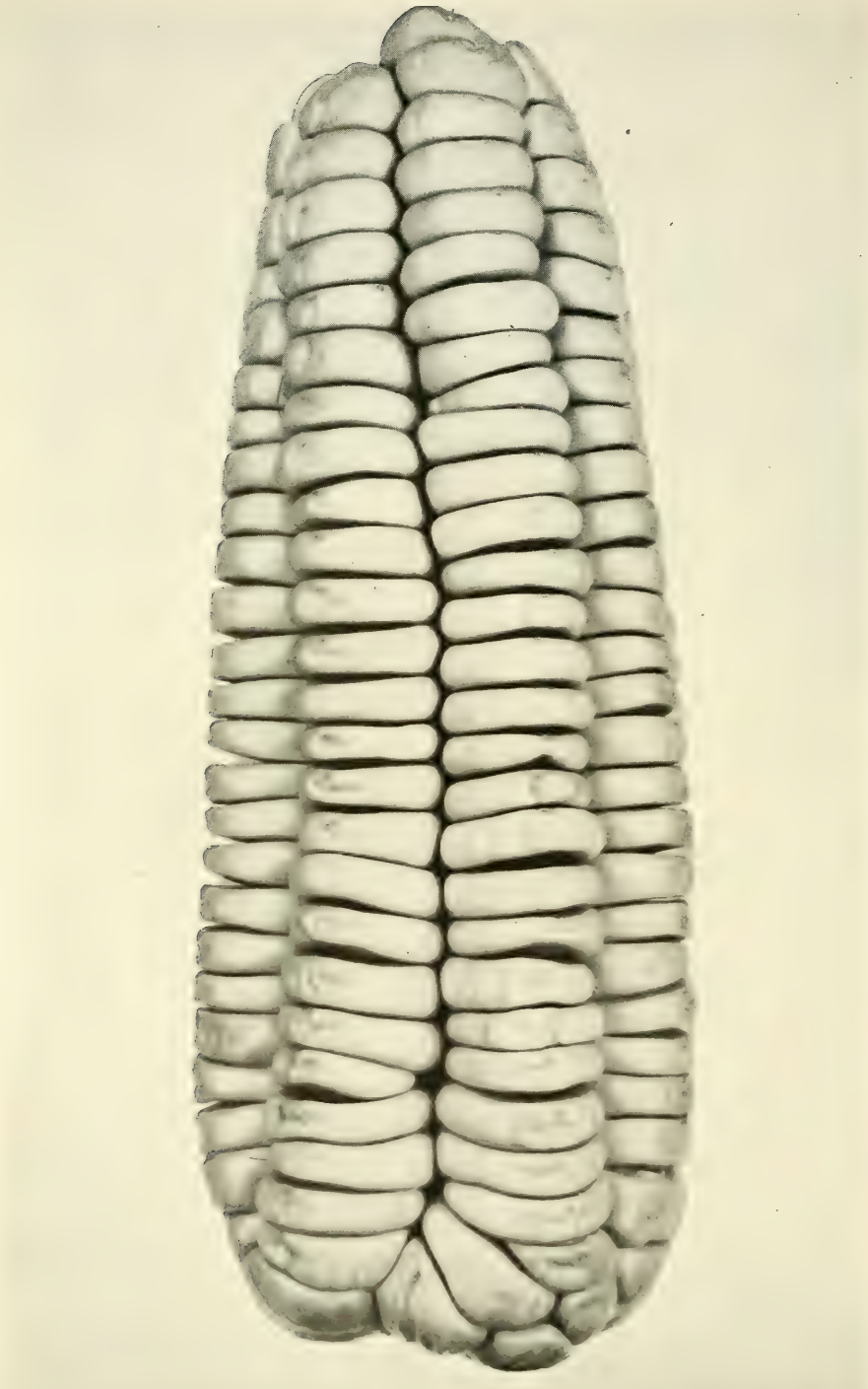
The rural Indians of Peru still believe in "paying the Incas", for fear that their crops will fail if the ancient observances are neglected. Burnt offerings of drugs and aromatic plants are still made and small images buried in the fields for the benefit of the crops and herds. Such are the stone carvings, called *mullo,* or *piedras de Charasani,* that are still sold in the native market of La Paz, Bolivia, shown in actual size in this photograph. Some of the carvings represent wives, boxes of money, or money in the hand; but most of them are definitely agricultural, showing potato fields, grain fields with irrigation channels, stacks, barns, and ranks of sheep or cattle, like the colonnades of bulls in ancient Egypt.

DESTRUCTION OF THE INCA SYSTEM

Agriculture was a fundamentally important step in the development of civilization, because it constituted the discovery of a way to live and let others live, too. As long as primitive man remained dependent upon game or natural products there was seldom enough to go around. The natural attitude of non-agricultural tribes roaming about in search of food is to fight all strangers on sight, and this attitude persists in many nations that have adopted agriculture as an art, but are not yet converted to it as an ideal or philosophy of existence.

Dominance of the predatory instinct is seen when people would rather raid the harvests of others than raise crops of their own. How thoroughly agricultural were the ancient Peruvians in habits and instincts is evidenced by their greater freedom from the predatory instincts in comparison with our European race. In this respect the Incas were admittedly superior. Several of the early historians give testimony to this aspect of the Inca civilization. Cieza de Leon and other thoughtful men among the conquerors saw very clearly that something had been destroyed that could not be replaced.

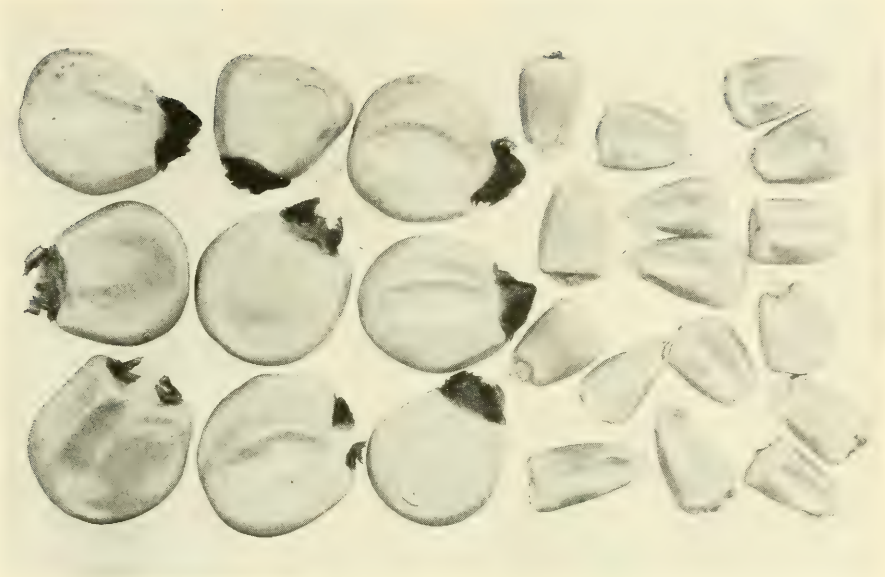
The most convincing testimony was given by one of the soldiers who came with Pizarro, the last survivor, he tells us, of the original band, who had the best opportunity of knowing what the Inca organization was before the conquest; and after all of his companions were gone, the idea of regret and remorse for the destruction that had been wrought grew in the mind of this aged warrior. He cast about for a way to discharge his conscience by telling the King of Spain the truth about the Inca civilization. He knew that the king's ear had been sought by many adventurers, who carried tales of wrongs to the Indians as a means of securing their own advantage, and that others had countered with tales of barbarous practices among the Indians, some of them fabricated and others carried over from the savage tribes of other parts of America. Also the truth was bitter, and the king might not hear it willingly; certainly nobody who hoped



Photograph by O. F. Cook

CUZCO, THE LARGE-KERNEL CORN OF PERU

In the middle farming zone of Peru, at elevations between 8,000 and 11,000 feet, the Cuzco type of corn is the principal crop. It is characterized by very large kernels, sometimes nearly an inch broad. Cuzco is native to the cool tablelands of Peru rather than the tropical valleys. This fact throws new light on its behavior in the United States. In the hot summer climate of the eastern States it usually fails to set seed, but it may be of use on the Pacific coast or other parts of the United States where there is too little heat for our varieties to mature (natural size).



Photograph by O. F. Cook

THE LARGE CUZCO KERNELS ARE EATEN ONE BY ONE

The huge size of the Cuzco kernels (shown on the left) is more apparent when compared with the kernels of Boone County white, one of our popular varieties (shown on the right). The large kernels are eaten one at a time in Peru, like grapes or chestnuts. The meat slips out of the skin when the boiled kernel is pressed between the thumb and finger. Ripe corn is eaten this way, as well as green corn, and is a staple article of diet among the Indians, who call it *moti* (natural size).

for royal favor would undertake to deliver such a message.

AN IRREPARABLE LOSS

The problem was not easy; but the aged warrior had a resourceful mind as well as an active conscience, and he found a way to give his testimony a lasting record. Instead of setting out on a vain journey to the court of Spain, he waited quietly at Cuzco and let death deliver his message to the king. As the last of the conquistadores, he claimed the right to send the king a legacy of truth regarding the Incas:

"True confession and protestation in the hour of death by one of the first Spaniards, conquerors of Peru, named Marcio Serra de Lejesama, with his will proved in the city of Cuzco on the 15th of November, 1589, before Geronimo Sanchez de Quesada, public notary.

"First, before beginning my will, I declare that I have desired much to give notice to his Catholic Majesty King Philip, our lord, seeing how good a Catholic and Christian he is, and how zealous in the service of the Lord our God, concerning that which I would relieve my mind of, by reason of having taken part in the discovery and conquest of these countries, which we took from the Lords Yncas, and placed under the royal crown, a fact which is known to his Catholic Majesty.

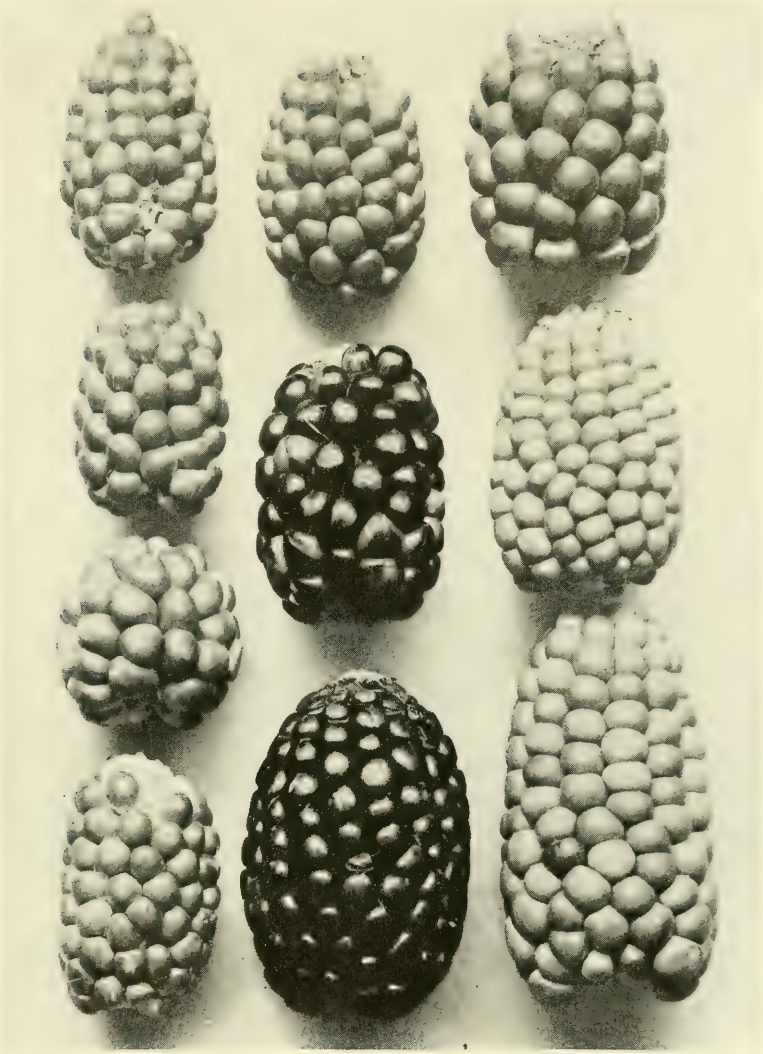
"The said Yncas governed in such a way that in all the land neither a thief, nor a vicious man, nor a bad, dishonest woman was known. The men all had honest and profitable employment. The woods, and mines, and all kinds of property were so divided that each man knew what belonged to him, and there were no lawsuits. The Yncas were feared, obeyed, and respected by their subjects, as a race very capable of governing; but we took away their land, and placed it under the crown of Spain, and made them subjects.

"Your Majesty must understand that my reason for making this statement is to relieve my conscience, for we have destroyed this people by our bad examples. Crimes were once so little known among them that an Indian with one hundred thousand pieces of gold and silver in his house, left it open, only placing a little stick across the door, as the sign that the master was out, and nobody went in. But when they saw that we placed locks and keys on our doors, they understood that it was from fear of thieves, and when they saw that we had thieves amongst us, they despised us. All this I tell your Majesty, to discharge my conscience of a weight, that I may no longer be a party to these things. And I pray God to pardon me, for I am the last to die of all the discoverers and conquerors, as it is notorious

Photograph by O. F. Cook

AGRICULTURE IS STILL PRACTICED INTENSIVELY HERE

These terraces, of rather irregular form, are in a thickly inhabited district about the temple of Viracocha, near Tinta, in the Vilcanota Valley, at an altitude of about 11,000 feet



Photograph by O. F. Cook

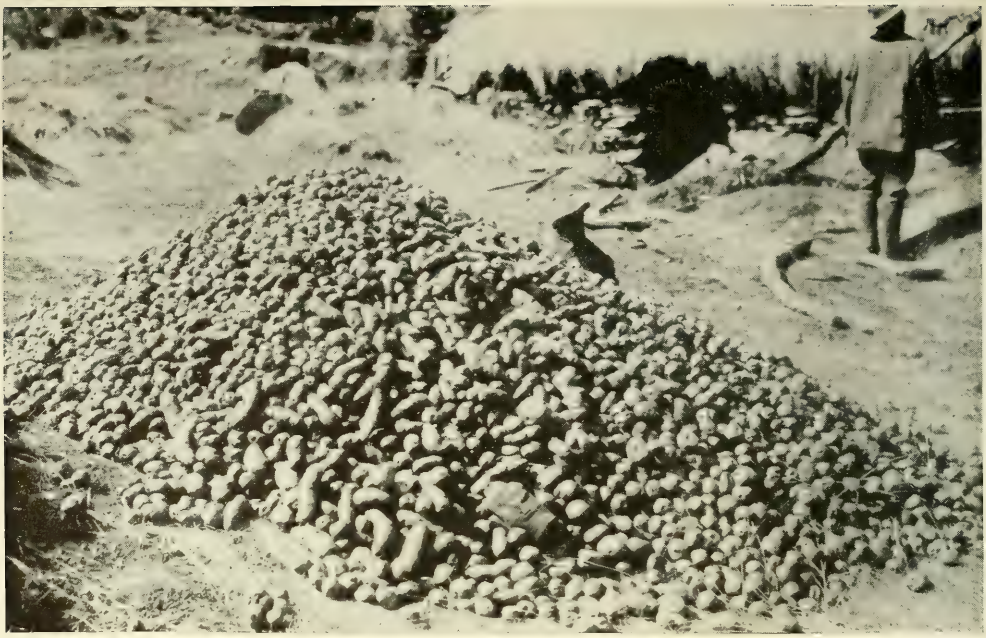
PIGMY CORN OF THE HIGHEST ALTITUDES, PICTURED SEVEN-EIGHTHS NATURAL SIZE

The culture of maize is carried to its extreme limit in a few places on the islands and slopes around Lake Titicaca, at an elevation of nearly 13,000 feet. The diminutive ears were bought in the market at Copacabana, on the south shore of the lake, where a great fair is held annually, near the end of the winter season, in August. In a planting of this type of corn on our Pacific coast, near San Diego, last year ears about twice as large were matured in sixty days, indicating that the Copacabana corn may be of use in breeding varieties for short-season conditions in the United States.

that there are none left but me, in this land or out of it, and therefore I now do what I can to relieve my conscience." *

The message carried its own verification. In testifying to the virtues of another race, Serra showed himself possessed of the highest virtues of his own, the love of truth and fairness, and a kindly interest in human welfare, beyond all bigotry of country, creed, or race. Many Spaniards appreciated the Incas, but were powerless to save them. The individual was helpless, for it was a clash of systems, with no basis of common understanding. Writers of large historical works like Garcilasso de la Vega and Cieza de Leon may be suspected of color-

* The Travels of Pedro de Cieza de Leon; translated by Clements R. Markham. Volume 33, Hakluyt Society, pages 32-33, 1864.



SIXTEEN POTATO VARIETIES FROM ONE FIELD

The pile is a mixture of many varieties grown at a high elevation near the Pass of Panticalla. The natives do not grow fields of separate varieties, although they distinguish and have names for many different sorts, which are widely recognized.

Photographs by O. F. Cook

THE POTATO, PERU'S GIFT TO MANKIND, HAS ENRICHED THE WORLD MORE THAN THE IMMENSE HOARDS OF GOLD TAKEN BY THE SPANIARDS

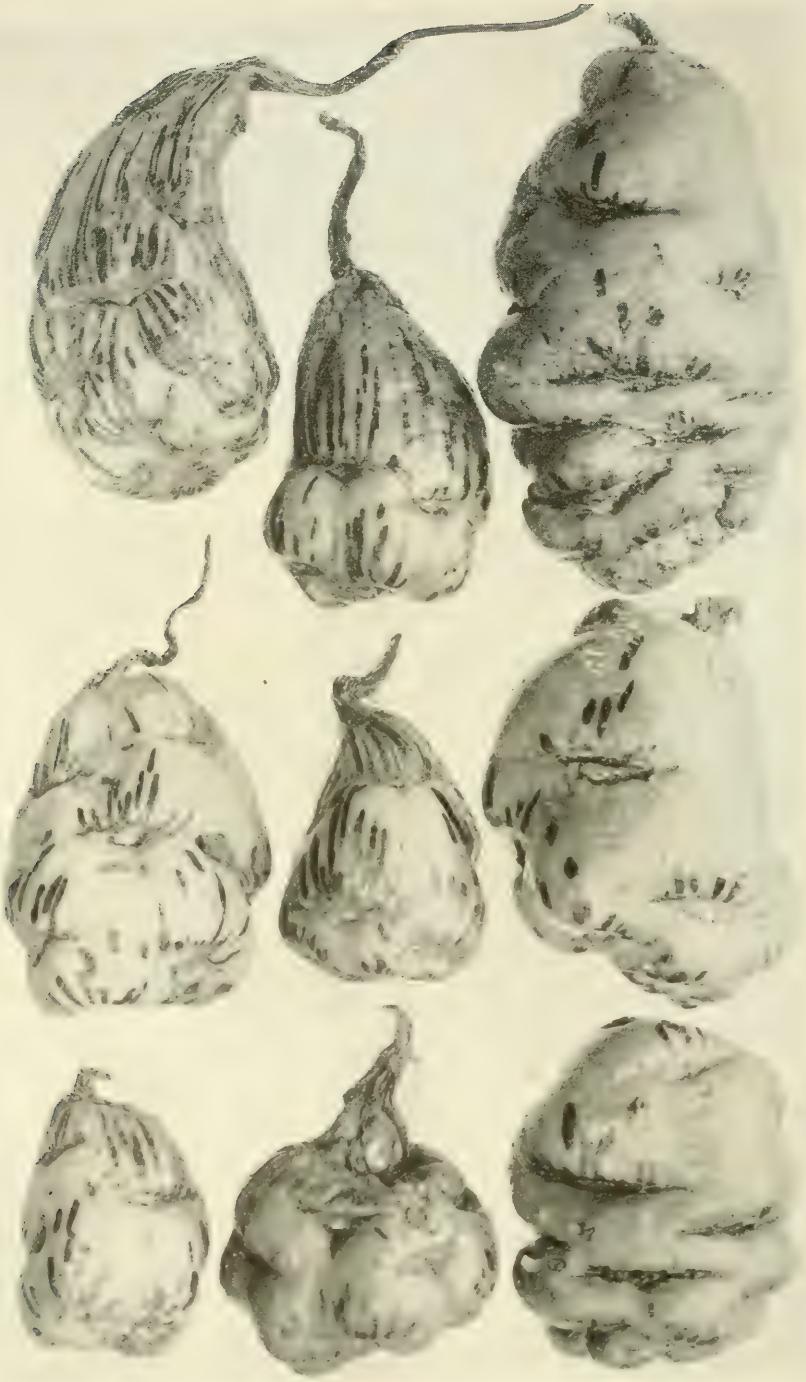
(SEE TEXT, PAGES 510-515)

The popularity of a potato in our market depends largely on whether it is easy to handle and peel. It would be hard to imagine a more convenient potato than this Peruvian variety, called *Pucasuaylla*, of regular, oblong, flattened form, even surface, and few, shallow eyes. It was found by Professor Bingham between Pucyura and Arma, at an altitude of about 12,000 feet (slightly reduced).

Photograph by O. F. Cook

THE HARDIEST POTATO

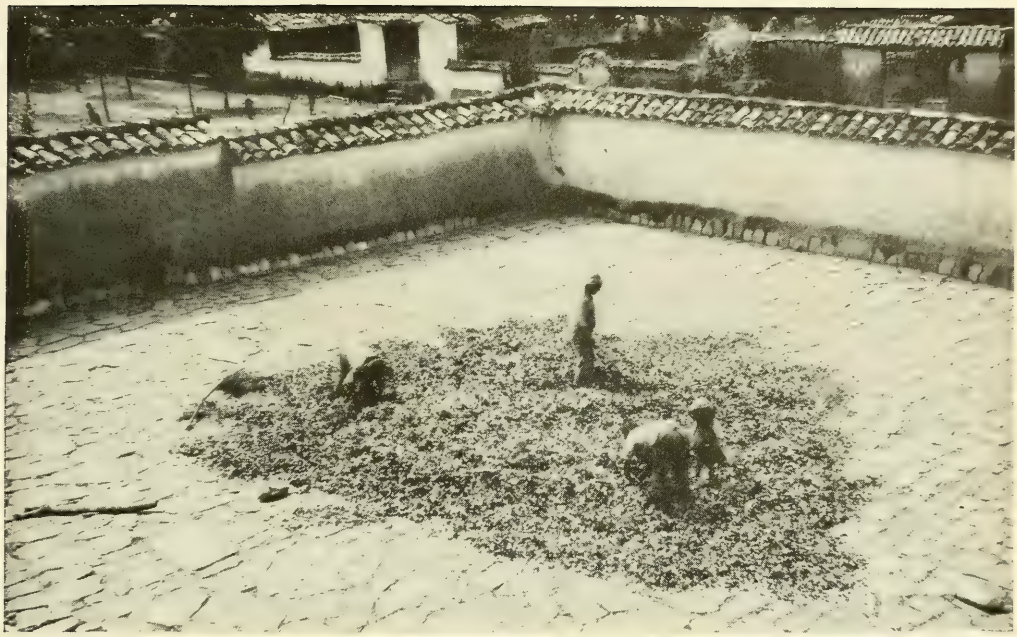
A variety of potato grown at the upper limit of cultivation, on the high slopes near the Pass of La Raya, at an elevation of over 14,000 feet. The neighboring vines had their leaves killed by the frost, but this plant was entirely uninjured. Both the rootstocks and the tubers are bluish purple. The variety called *Tutu* is said not to be edible in the fresh state, and to be used only for the making of *chuños* by freezing and drying (natural size).



Photograph by O. F. Cook

IN ADDITION TO THE POTATO, PERU HAS ORIGINATED MANY VALUABLE ROOTS (SEE PAGES 513-515)

These are not specimens of hand-decorated Japanese art, but were striped by nature before the tubers were dug. Why the subterranean part of a plant should be decorated with purple stripes is hard to imagine, but the case may be interesting to those who believe that colors must be useful. Two varieties are shown, both called *Checjcheañu*, at Ollantaytambo. The variety at the right, with the larger and more irregular tubers, also has the stripes fewer, shorter, and of a deeper purple color (natural size).



Photograph by O. F. Cook

COCA-DRYING YARD AT SANTA ANA

The leaves are spread out on the stone pavement and dry rapidly in sunny weather. Rainy weather interferes seriously with the drying operation, for the leaves may have to be spread out and carried in several times. If a sudden rain wets the coca before it can be taken under cover, the leaves are discolored and their commercial value is reduced.

ing their accounts to convey a special impression, but no literary bias can be suspected in Serra. He tells us only a few facts, but in a way that proves his competence to speak. His testimony is not in conflict with the best historians, but more vital and convincing.

If Serra had charged the destruction of the native civilization to Pizarro or to any of those afterward in authority in Peru, it would be possible to suppose that his view of the Inca organization was colored by revenge or lasting resentment against some of his own people; but of this there is no indication. He includes himself with the others, blames nobody, and suggests no remedies. Telling the truth to the king is all that he undertakes; but in doing that he lifts the curtain of the past and lets us see for one moment through his eyes, not the mountains or the monuments or the crops of Peru, but the living Inca people and their relations to each other, the most essential condition of the development of the ancient civilization.

THE INCAS HAD THE MOST COMPLETE SOCIAL ORGANIZATION OF WHICH WE HAVE RECORD

We see that the Inca agricultural system was not only the most complete form of social organization of which we have any record, but also gave the most adequate adjustment of the human relations that lead to continual conflict and confusion in other forms of society.

This is not saying that the Inca system was the best possible, or that it was calculated to lead to the highest development of humanity, or that we should adopt it; but the system is interesting and worthy of being understood, since social organization undoubtedly was a very important factor in enabling the Incas and their predecessors to accomplish what they did in agriculture and the attendant arts. Certainly no unorganized people could have executed the ancient reclamation projects or established themselves under so wide a range of natural conditions or domesticated such a varied series of crop-plants. In domesticating these plants

Photograph by O. F. Cook

WHERE FARMING IS UPHILL WORK

This coca plantation is on a very steep hillside near Colpani, in the lower Urubamba Valley, at an elevation of about 5,000 feet. Many plantations are made in this way on steep slopes. Contrary to the custom that prevails in most tropical countries, the rows always run up and down the slope instead of across.

Photograph by O. F. Cook

LEAVES, FLOWERS, AND MATURE BERRIES OF THE COCA PLANT

All the parts are shown in natural size. The leaves, which are the source of the cocaine drug, are very peculiar. The two surfaces are quite unlike—the upper, deep green, smooth, and velvety; the lower, light green, with a band of paler color on each side of the midrib, inclosed by fine ridges. The young leaves are rolled in from the margins, so that only this median band of the lower surface is exposed at first.

Photograph by O. F. Cook

A LARGE COCA PLANTATION AT SANTA ANA

The crop of leaves has just been harvested, leaving the bushes stripped. As soon as the leaves are gathered, the plantation is irrigated and another crop of leaves begins to grow, and matures in about three months. With four crops in a year a good coca plantation is very profitable for the owner and government (see page 473), but a cause of much misery and degradation to the people. Santa Ana is a famous place, having been the chief center of missionary activity in the eastern valleys of the Andes in the early colonial period. The buildings were constructed by the Jesuit fathers.

Photograph by O. F. Cook

A NATIVE PERUVIAN COTTON

Leaf, flower, and boll of the native cotton grown in the eastern valleys of the Andes. This species (*Gossypium barbadense*) is entirely different from any grown in the United States. The plant is somewhat like the Sea Island cotton, but the bolls are much larger than those of Sea Island and the fiber is more like Upland cotton (natural size).

Photograph by O. F. Cook

THE TREE TOMATO, CYPHOMANDRA

It is a relative of the true tomato, but is more upright, with a single strong stalk and horizontal branches at the top, forming a small tree five or six feet high. The fruits are narrowed at both ends, yellowish red in color, firmer in texture than our tomatoes and with a somewhat stronger taste. The plant endures more cold than the true tomato and is cultivated at elevations of 6,000 to 10,000 feet, whereas the true tomato is raised only in the warm valleys, below 6,000 feet (natural size).

Photograph by O. F. Cook

A WILD-CHERRY TOMATO OF THE URUBAMBA VALLEY

Wild tomatoes of the cherry type are very abundant in the lower Urubamba Valley about Santa Ana at an elevation of approximately 3,000 feet. The color of the fruits is deep red and the taste very agreeable. The tomatoes cultivated by the Indians are of the same type and the fruits not much larger (natural size).

Photograph by O. F. Cook

A WILD TOMATO OF THE EASTERN ANDES

Growing as a large woody vine at elevations of 8,000 feet, this plant trails over bushes 10 to 12 feet high. The fruits are of uniform size and of the usual form of our cultivated tomatoes. The flesh under the skin is thick and firm, so that the fruits can be handled easily and kept for long periods. There is a possibility of making use of it in hybridizing and breeding new varieties. If such a cross can be made, it may be expected to give a wide range of variation and yield new types of fruit adapted to special purposes, such as woody perennial varieties that can be trained over arbors like grape-vines, or varieties with special flavors, greater firmness of flesh, and improved keeping qualities (natural size).

the ancient Peruvians performed a lasting service for the whole world. We are all beneficiaries of the ancient Peruvian agriculture.

From our point of view, the steep, narrow, rocky valleys of southern Peru would represent a most unfavorable condition for agricultural development; but no doubt the ancient people saw things in a different light, and what they were able to accomplish is a lesson in possibilities that our own race has still to learn. We are beginning to see that the agricultural ideal of human welfare, of living and letting others live around us, is higher than the military or savage ideal of killing all strangers through fear or jealousy of competition. But our traditions, literature, and social institutions are still so largely military or commercial that we have not seriously considered agriculture as an aim or ideal of existence. We have not sent forth our imaginations to grasp a vision of agricultural development, either for humanity as a whole or for our own European race in the new continent that we have overrun but not yet occupied.

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE WILD BLUEBERRY TAMED

The New Industry of the Pine Barrens of New Jersey

BY FREDERICK V. COVILLE

BOTANIST OF THE U. S. DEPARTMENT OF AGRICULTURE

IN AN article published last year describing the successful outcome of experiments in the growing of trailing arbutus from the seed, the incidental statement was made that "in the first trial blueberry plantation, in the pine barrens of New Jersey, blueberries are now produced of the size and color of Concord grapes."* This allusion aroused so much interest among the readers of the NATIONAL GEOGRAPHIC MAGAZINE that the writer has been asked to expand his statement into a description, with illustrations, of the progress that has been made in the new industry of blueberry culture.

Five years ago, in this Magazine, a description was given by the writer of certain physiological peculiarities of the blueberry plant in which it differs fundamentally from the ordinary plants of agriculture.† When given the kind of care, protection, and nourishment usually bestowed on cultivated crops, the blueberry sickens and dies (see picture, page 536).

In a search for the cause of this peculiar behavior it was found that the healthy blueberry plant has on its roots a minute fungus, invisible without the aid of a compound microscope, which, unlike most fungi, appears to be beneficial, not injurious, its particular beneficent action being to furnish nitrogenous food to the blueberry bush. So intimate, indeed, is the relation between the two that the blueberry appears unable to nourish itself properly without the assistance of the fungus.

The problem of blueberry culture, therefore, became primarily the problem of growing the blueberry fungus, and the solution of this second problem lay in the character of the soil. The blueberry fungus requires an acid soil, and it thrives best in one composed of leaf peat and sand. The pine barrens of New Jersey afford just that kind of soil, with every variation in moisture from permanent bog to areas of pronounced aridity.

The failure of earlier experimenters, and there have been several in the last 50 years, to establish an industry of blueberry culture was due primarily to their failure to recognize that an acid soil is the first essential of successful blueberry production.

Before showing what has been done in the way of commercial blueberry culture in the pine barrens of New Jersey, it may be well to contrast an illustration of the

* The Cultivation of the Mayflower. NATIONAL GEOGRAPHIC MAGAZINE, May, 1915.

† Taming the Wild Blueberry. NATIONAL GEOGRAPHIC MAGAZINE, February, 1911.

Photograph from U. S. Department of Agriculture

BLUEBERRY PLANTS, SHOWING THE BENEFICIAL EFFECT OF ACID SOIL AND THE INJURIOUS EFFECT OF RICH GARDEN SOIL

The three large blueberry plants, one year old, were grown in a greenhouse in a peat soil. All three are over twenty-four inches high. Standing on the middle pot is a small glass pot containing a seedling of the same age and origin as the others, but potted in a rich garden soil. The difference in results shows the fundamental importance of a peaty acid soil for blueberry culture.

greenhouse blueberry of 1911 with that of 1916, for the greenhouse and laboratory experiments have been the constant guide of the field plantation (see pages 538 and 539).

While the largest individual berries have been grown in the greenhouses at Washington, the finest clusters and the best formed and most productive bushes have been reared outdoors in the New Jersey plantation. Furthermore, the field plants have reached the stage of commercial bearing at a much earlier age than was expected from observations on the greenhouse plants.

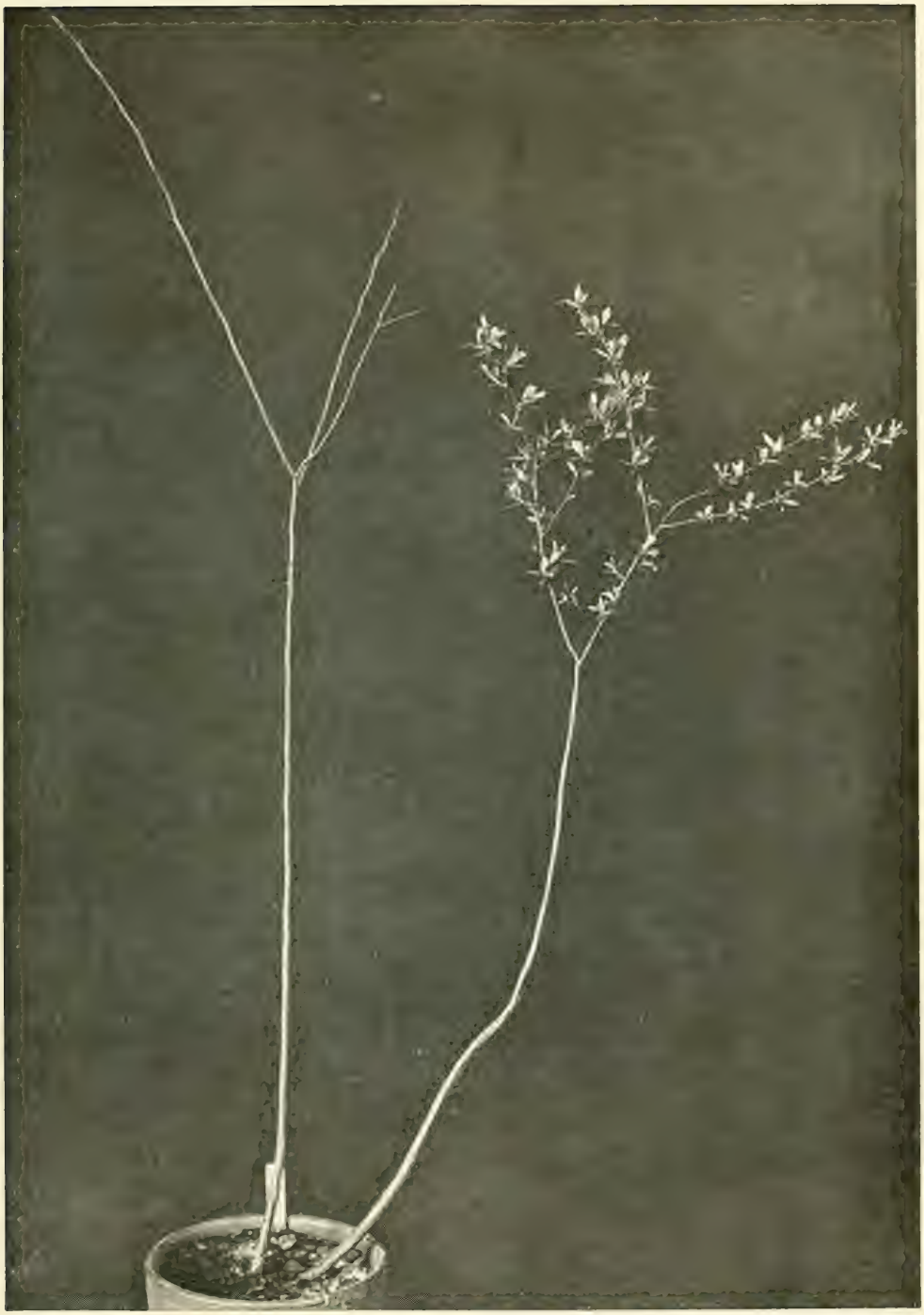
In the article published in 1911 the conservative view was advanced that blueberry seedlings or cuttings would come into profitable bearing, under proper culture, in five to ten years. In the New Jersey plantation hybrid seedlings have borne their first commercial crop when only three years old and a crop three times as large when four years old.

THE BLUEBERRY BUSH LIVES A MAN'S LIFETIME

Under such favorable conditions as exist in the pine barrens, therefore, blueberry culture is to be classed, as to the age of first bearing, not with the slow-fruiting apple orchard, but with the quick-fruiting peach, with this important difference, however, that while the peach tree remains in vigorous fruiting condition for comparatively few years, the blueberry bush, with suitable pruning, bids fair to last a man's lifetime and even longer.

There was once pointed out to me by a man of sixty a handsome, vigorous blueberry bush which he had known from his boyhood and which he said seemed to him just as large and vigorous then as now, and just as highly distinguished among all the blueberries of the region, for it was an albino bush and bore delicious white blueberries for the boys at the swimming-hole in his childhood just as it does today.

Still further prospects of longevity does the wild blueberry possess. The tall decrepit veteran with densely interwoven and half-dead twigs and feebly moving sap in its old and rheumatic limbs has a means of rejuvenation which nature has not granted to the trees of the old apple orchard. If such an old blueberry bush is burned to the stump, there springs from its ashes a new bush, characterized



Photograph from U. S. Department of Agriculture

BLUEBERRY PLANT, SHOWING THE EFFECT OF COLD IN STIMULATING GROWTH

The stem at the right was kept outdoors, through a hole in the glass side of a greenhouse, exposed to repeated freezing and thawing during the winter months. When spring came this outdoor stem burst into growth, as shown in the illustration; but the stem at the left, which was inside the warm greenhouse all winter, remained completely dormant. A knowledge of this influence of cold in stimulating the growth of the blueberry is of fundamental importance in the propagation of choice blueberries by cuttings.

Photograph from U. S. Department of Agriculture

THE GREENHOUSE BLUEBERRY OF 1911

This illustration was published in the National Geographic Magazine for February, 1911, as an example of the fruit of a cultivated blueberry. These berries, reproduced in their natural size, were among the first that were produced on greenhouse plants. The plant itself was a seedling from a large-berried wild bush.

not only by the symmetry and beauty of youth, but by youth's vigor and fruitfulness as well. The wild blueberry is the real and literal phœnix among fruits.

BLUEBERRIES ARE AS DIFFERENT AS INDIVIDUALS

The development of a large-fruited blueberry is very desirable from the standpoint of the grower, for not only is the cost of picking much reduced, but the market price is much increased. One characteristic of the blueberry, however, is of far more importance than size, namely, flavor. When one buys blueberries in the market he gets a mixture of berries from many bushes, and the composite flavor is always good.

It would be a mistake, however, to infer that the blueberries from all wild bushes are of good flavor. They are not. In selecting wild bushes bearing large and handsome berries, to be used as breeding stocks, it has been found that some wild blueberries are sour, others insipid, other rank or even bitter in taste.

All bushes whose berries are devoid of sweetness and the special flavor that characterizes the most delicious blueberries are rejected for breeding purposes, however large or externally beautiful their fruit may be. It is confidently expected that the hybrids produced from such selected parents not only will average better in flavor than the wild berries, but that an occasional hybrid will excel in this respect the best wild berries that we know (see pages 540 to 543).

The improved and cultivated blueberry will be above criticism as to the size of its seeds. All the large-seeded species of this class of berries belong to the true

Photograph from U. S. Department of Agriculture

THE GREENHOUSE BLUEBERRY OF 1916

This cluster contains the largest blueberry produced up to the present time. It measured seven-eighths of an inch in diameter. A bud from the largest-berried plant thus far known was inserted on a very vigorous seedling stock, was forced to rapid and luxuriant growth in the greenhouse, and finally was made to produce these berries. They are shown in their natural size.

huckleberries, and none of these has been used in the breeding experiments.*

PROPAGATED BY CUTTINGS

From the many thousand hybrids testing and to be tested in the New Jersey trial plantation a few bushes bearing the best-flavored, largest, and handsomest berries will be selected for further propagation. Like selected varieties of apples, selected blueberries cannot be propagated successfully from the seed. They do not come true in that way. They do come true, however, when budded or grafted; but, as new shoots are continually springing up below the graft, these methods also cannot be applied satisfactorily to the blueberry.

As early as 1909 it was appreciated that propagation must be effected by cuttings or some similar method, if a particular selected bush was to be perpetuated and increased on a commercial scale. The various methods followed by gardeners in the rooting of cuttings of ordinary plants were faithfully tried, but without success. Thousands of cuttings that started well drooped and died in the cutting beds.

It became evident that new methods

*In the southern United States and in the Middle West blueberries are not ordinarily distinguished from huckleberries, but in New England the distinction is very clearly drawn. The name huckleberry is there restricted to plants of the genus *Gaylussacia,* the berries of which contain 10 large seeds with bony coverings like minute peach pits, which crackle between the teeth. The name blueberry is applied in New England to the various species of the genus *Vaccinium,* in which the seeds, though numerous, are so small that they are not noticeable when the berries are eaten. It is probable that the comparatively low estimation in which this fruit is held in the South is largely due to the lack of a distinctive popular name and the consequent confusion of the delicious small-seeded southern Vacciniums with the coarse large-seeded Gaylussacias. It is the culture of the small-seeded blueberries only, as distinguished from the large-seeded huckleberries, that is here advocated.

Photograph from U. S. Department of Agriculture

THREE-YEAR-OLD BLUEBERRY HYBRID IN COMMERCIAL BEARING

This plant is a hybrid between two selected wild stocks, from Greenfield, New Hampshire, and Brown Mills, New Jersey. They were hybridized in the greenhouses at Washington in the summer of 1912 and the hybrid seeds were sown September 9. The young plants were carried over winter in the greenhouse, and early in September, 1913, they were set out at Whitesbog, in the New Jersey pine barrens. The photograph was taken July 27, 1915, when the plant was a little less than three years old. It is about one-fifth natural size.

must be devised for the rooting of blueberry cuttings, and a detailed study of the subject was therefore begun. For the first few years the varying course of the experiments with cuttings brought a continual alternation of high hopes and severe disappointments.

During those years, however, there began to accumulate from the experiments a definite knowledge of what not to do, and at the same time glints of future success came from occasional cuttings that did develop roots and grow into healthy plants. At last the way became clear, and now cuttings of the choicest plants can be rooted and grown with almost the certainty of seedlings.

THE EFFECT OF COLD

Some of the discoveries made in the course of this investigation are sufficiently curious to be of general interest. One of these is the effect of cold in stimulating the growth of the plant. After

Photograph from U. S. Department of Agriculture

FOUR-YEAR-OLD BLUEBERRY HYBRID

This is one of a series of hybrids made in 1911 between selected wild plants of a low-bush blueberry (*Vaccinium angustifolium*) and a high-bush or swamp blueberry (*Vaccinium corymbosum*), both from Greenfield, New Hampshire. The photograph was taken July 7, 1915, in a field plantation at Whitesbog, New Jersey. The bush bore two quarts of berries and is shown about one-sixth natural size. This lot of hybrids yielded at the rate of twenty bushels of berries per acre at a spacing of three by five feet.

consideration of the puzzling misbehavior of blueberry plants in the greenhouse in winter, the following experiment was tried.

A small opening was made in the glass side of a greenhouse in early January, and through this opening was pushed one of the two stems of a blueberry plant which up to that time had been kept in the warm atmosphere of the greenhouse. The open space about the stem where it passed through the glass was then carefully plugged with moss. During the rest of the winter the plant remained in the same position, the pot and one stem continuing in the warm temperature of the greenhouse, while the other stem, projecting through the glass, was exposed to the rigors of winter, with its alternate freezing and thawing.

When spring came the outdoor stem burst into leaf in the usual manner of a wild blueberry plant, but the stem that had been in the warm greenhouse all win-

Photograph from U. S. Department of Agriculture

A CLUSTER OF OUTDOOR BLUEBERRIES ON A THREE-YEAR-OLD HYBRID

This cluster of berries, which is of natural size, was grown on one of the hybrid bushes in a plantation at Whitesbog (near Brown Mills), in the pine barrens of New Jersey. The berries had a very light blue color, firm but juicy flesh, exceptionally delicious flavor, and seeds so small as not to be noticed when the berries were eaten. The small berries on the cluster were still green. Such berries increase rapidly in size during the few days of ripening.

ter showed neither leaves nor swelling buds. Although perfectly healthy, it remained completely dormant, notwithstanding the fact that it had been surrounded for months by just the conditions of warmth and moisture that ordinarily make blueberry plants grow luxuriantly (see page 537).

The experiment was repeated many times, with various modifications. In some instances the pots were kept outside the greenhouse and one of the stems

Photograph from U. S. Department of Agriculture

PLANTATION OF THREE-YEAR-OLD BLUEBERRY HYBRIDS AT WHITESBOG, NEW JERSEY

These hybrids, photographed in their third year from the seed, were then producing their first commercial crop, seven bushels per acre. The rows are five feet apart and the plants three feet apart in the row, too close a spacing for a permanent plantation (which should be eight by eight feet), but correspondingly more productive in the earlier years.

inside. In other cases the stems were severed from the root, packed in moss or moist sand to prevent drying, and exposed inside or outside the greenhouse.

From these experiments the fact was definitely established that when a blueberry plant has completed its active growth of spring and summer, and later in the season has gorged its twigs, stems, and roots with starch and other storage foods for early spring use, it becomes dormant and, shedding its leaves, refuses to grow again at the temperatures which in spring and summer would be most favorable to its growth.

But after the plant has been exposed to prolonged chilling, at a temperature a little above freezing, it is ready again to grow, and then it is that under the influence of warmth, whether furnished naturally by the sunny days of spring or artificially from the rusty heating pipes of a greenhouse, the buds swell and the plant leaps forward in a riot of rejuvenescence and reproduction.

One change that takes place in the blueberry stems during the period of chilling is the transformation of the stored starch into sugar. The starch must first be turned into sugar before the plant can use it for food, and that change the chilling accomplishes. In the warm

Photograph from U. S. Department of Agriculture

SELF-POLLINATION VERSUS CROSS-POLLINATION

These two twigs, both shown in natural size, were in equally good situations on the same bush, contained the same number of flowers, all pollinated by hand at the same time with equal care, and the fruits were photographed on the same day. The only difference in treatment was that the pollen used on the left-hand twig came from other flowers on the same bush, while the pollen for the right-hand twig was taken from another bush. The cross-pollinated flowers produced a full cluster of handsome berries. The self-pollinated flowers produced no ripe fruit, all the berries that set remaining small and green and later dropping off, until at the time the photograph was taken only two imperfect ones remained. A plantation made up wholly from cuttings from a single bush would produce little or no fruit. At least two original propagation stocks are necessary.

greenhouse there is no accumulation of sugar, the starch remains in storage, and no growth takes place.

THE BUDS ARE PUSHED OPEN BY ENORMOUS INTERNAL PRESSURE

Along with the formation of the sugar, and caused in part by its accumulation, there develop within the minute cells of the plant enormous internal osmotic pressures, which enable the plant to push its buds open.

These pressures are frequently as high as seven atmospheres, or more than 100 pounds to the square inch—a stress that would start a leak in a low-pressure steam-engine. The pressures may become as high as 30 atmospheres, or 450 pounds to the square inch—a force sufficient to blow the cylinder head off of a thousand-horsepower Corliss engine.

The reason that the plant does not explode is because it is broken up into many extremely small and strongly built cells instead of having one big interior cavity. These minute chambers are often as thick-walled proportionally as an artillery shell and, in the case of the starch-storage cells of the blueberry, are clearly of such construction as to be able to withstand enormous pressures.

It turned out that a full understanding of the behavior of blueberry stems when exposed to prolonged chilling was of the utmost importance in the treatment of blueberry cuttings. Limitations of space prohibit the discussion of other phenomena encountered in the experiments. It

Photograph from U. S. Department of Agriculture

A QUART OF SELECTED FIELD-GROWN BLUEBERRIES

This illustration shows, in its natural size, a quart box of selected blueberries grown in the plantation of Miss Elizabeth C. White, at Whitesbog, New Jersey, in a peaty, well-watered, pine-barren soil. There are thousands of acres of such soil in the southeastern quarter of New Jersey now lying unused for any agricultural purpose.

may merely be stated that after each of the essential principles was clearly understood special methods for rooting blueberry cuttings were perfected without serious difficulty and are now in practical operation in the field.

Reference has already been made to the breeding experiments aimed at the production of new and superior varieties of blueberries. In the course of these experiments one fact turned up which merits comment here, because to its curious interest is added its great practical importance in the actual field culture of the blueberry.

An attempt was made to ascertain whether an especially fine blueberry variety could not be made to come true from the seed by pollinating flowers of the individual plant with its own pollen, just as has commonly been done in the breeding of choice varieties of vegetables. From these self-pollinations, however, few berries and seeds were secured.

In all cases, although the pollinations were made very carefully by hand, the

berries that resulted from self-pollination were smaller and later in maturing than cross-pollinated berries on the same bush. On some bushes not a berry matured from many self-pollinations. The same relation exists between the flowers of two plants grown from cuttings of the same bush. These plants behave like different parts of one plant and set little or no fruit from each other's pollen.

From these experiments it became clear that if a blueberry grower should set out a whole field with plants from cuttings of a single choice bush his plantation would be practically fruitless, because it would contain no other blueberry stock from which the bees in their search for nectar could bring the unrelated pollen required to enable his choice plants to set fruit. The best procedure is to make up the plantation with alternating rows of plants propagated by cuttings from two choice varieties. Each will then set fruit in abundance through pollination by the other (see page 544).

The introduction of the blueberry into agriculture has a much more profound significance than the mere addition of one more agricultural industry to those already in existence. Blueberries thrive best in soils so acid as to be considered worthless for ordinary agricultural purposes. Their culture, therefore, not only promises to add to the general welfare through the utilization of land almost valueless otherwise, but it offers a profitable industry to individual landowners in districts in which general agricultural conditions are especially hard and unpromising, and it suggests the possibility of the further utilization of such lands by means of other crops adapted to acid conditions.

AMERICA'S SURPASSING FISHERIES

Their Present Condition and Future Prospects, and How the Federal Government Fosters Them

By Hugh M. Smith

United States Commissioner of Fisheries

THE early history of France, Spain, Portugal, and England in the New World is to a very considerable extent centered in the fisheries. The tales of fabulous quantities of cod, herring, etc., brought back by the European navigators to the western shores of the Atlantic were the principal single inducement or incitement to further voyages of adventure and discovery; and the verification of these tales was a potent factor in subsequent colonization.

A cod fishery about Newfoundland was conducted by Normans and Bretons as early as 1504, and there is a tradition among the fishermen of the Bay of Biscay that one of their number who had been fishing in the western Atlantic informed Columbus of the existence of land in that region before the illustrious explorer had begun his memorable voyages.

A very able American writer on the early fisheries of the country makes a plausible case in favor of his contention that the Pilgrims could not have escaped the fishing mania which affected all other people of maritime Europe at the time, and that these weary exiles in Holland, noting the riches acquired by the Dutch from their fisheries, could not have been unmoved by the accounts of the vast shoals of fish to be found on the shores of the New World.

The settlement of Massachusetts colony was due directly to the fisheries, and the original proprietors of New Hampshire went there for the sole purpose of

acquiring wealth by fishing and trading. The first articles exported from New England were fish, and the commerce and navigation of that section were founded on fish. Most of the conflicts between the English and French colonies, which continued for 150 years and terminated on the Plains of Abraham, grew out of or involved disputes over the fisheries.

With the extension of our country, new aquatic wealth was found and utilized, contributing materially to early development and subsequent prosperity; particularly noteworthy were the oyster beds and river fishes of the Middle and South Atlantic States, the whitefish and other food fishes of the Great Lakes, and the salmons of the Pacific States.

With the acquisition of Alaska there came to us marine resources of such transcendent value as to overshadow all other natural products and to give the United States fisheries the leading place among the nations.

The creatures which support our fisheries are not all fish, but belong in various classes, some of those contributing most notably to the importance of the industry being crustaceans and mollusks. In a total annual value at the present time of approximately $76,000,000, the relative and actual importance of the different groups is shown in the accompanying diagram.

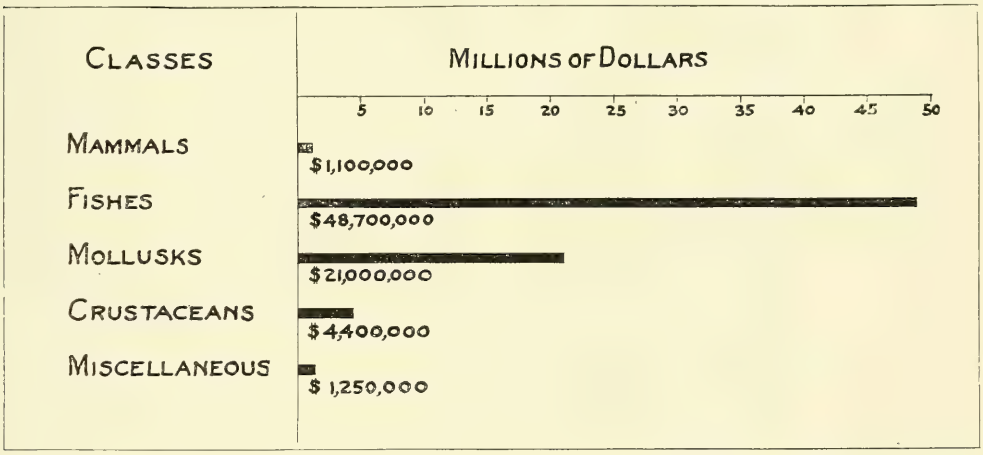


ILLUSTRATION OF THE ANNUAL VALUE OF AMERICA'S FISHERIES

The oyster industry accounts for the principal value of the mollusk fisheries, while the lobsters and crabs constitute the principal part of the crustacean catch. Seals and whales contribute the bulk of the returns of the mammal fisheries.

THE VANISHING WHALES

Most prominent among the aquatic mammals are various kinds of whales and the Alaskan fur seal. At the outbreak of the American Revolution and for a period of 75 years following the conclusion of that struggle, whaling was the most important branch of the American fisheries. From 500 to 700 vessels sought whales in all the oceans and seas of the world, and in one year New Bedford alone sent out 300 vessels, whose cargoes of bone and oil were the basis of the industrial life of the city.

The pursuit of sperm whales reached its climax in 1837, when oil valued at nearly four and a half million dollars was brought in, mostly from the South Pacific. The height of the industry was in 1846, when 70,000 persons derived their support from whales, and 720 vessels, valued at $21,000,000, were engaged.

For more than fifty years the fishery has been declining, and in numerous ports that once derived most of their wealth from the industry there have for a long time existed only memories of former greatness. For a number of years the

Photograph and copyright by Asahel Curtis

INDIANS STRIPPING THEIR PREY AT NEAH BAY: WASHINGTON

Whenever the coastal Indians kill a whale, they have a feast, literally gorging themselves with the flesh, blubber, and other parts

sperm, right, and bow-head whales that supported the fishery in early years have been very scarce and their pursuit has been unprofitable; and the present importance of the whale fishery, amounting in value to less than 2 per cent of the American fisheries, depends on the taking from shore stations of species of whales that formerly were for the most part neglected.

The glory of the whale fishery has departed forever, and the commercial, if not the biological, extinction of all kinds of whales is proceeding rapidly, undeterred and unlamented by the principal maritime powers.

THE ALASKAN SEAL HERD RESTORED

The Bureau of Fisheries is the official custodian of the most valuable herd of animals that any government of the world possesses. This is the herd of fur seals which roam over the eastern side of the north Pacific Ocean and return for breeding purposes to the Pribilof* Islands. After being sadly decimated by indiscriminate slaughter at sea, the herd has been rapidly recuperating under the influence of an international agreement, and soon the fur seals may be as numerous as when they came into the possession of the United States Government with the purchase of Alaska.

The fact that the only land to which these animals ever resort is two islets in Bering Sea belonging to the United States gives our government a claim to possession such as is exercised over no other wild creatures of water, land, or air. This governmental ownership or jurisdiction is the only reason why the fur seal has not long ago succumbed to the fate that is rapidly overtaking all the other large marine animals.

In the summer of 1916 more than 100,000 young seals will have been added to the Alaskan seal herd, whose total strength will then be upward of 400,000 individuals of all classes. For some years only a limited number of seals have been utilized for the food purposes of the natives; but after the present close-time law expires, in 1917, there will be available for commercial use many young male seals, which add nothing to the reproductive capacity of the herd and may properly be utilized for their skins and other products.

In fact, the seal herd may be managed after the manner of a herd of cattle or sheep, and if handled in a strictly scientific way will add to the Federal treasury a very handsome revenue, which will increase yearly as long as the existing international arrangement continues.

Meanwhile a revolution will have occurred in the world's fur-seal trade, for the Department of Commerce has changed the old order of things, and, for the first time, this American product, belonging to the American public and most largely used by American women, will be sold in an American market, instead of being sent abroad for sale; and the peculiar dressing and dyeing process, which is necessary to bring out the beautiful qualities of the Alaskan sealskin, will likewise have been brought from abroad and established in America.

THE ASTONISHING FISH LIFE OF OUR COASTAL AND INTERIOR WATERS

To give a mere list of the American fresh-water and salt-water fishes which support important industries would require several printed pages, for there are few, if any, countries that can boast of a larger variety of highly valuable fishes.

Every person familiar with the north Atlantic coast will recall the prominent place occupied by the cod, haddock, hake, pollock, halibut, mackerel, bluefish, herring, squeteague, sea-bass, scup, and swordfish, all of which are staple foods. On the south Atlantic seaboard the major food fishes are the mullet, croaker, spot, Spanish mackerel, in addition to the bluefish and squeteague. In the Gulf of Mexico the mullet and red snapper hold front rank among a host of excellent species. The Pacific coast supports a great profusion of flounders and rockfishes, and, to the northward, cod, halibut, and herring in extraordinary abundance.

The migratory fishes of our seaboard streams are not equaled in abundance,

* See "Making the Fur Seal Abundant," by Hugh M. Smith, in the NATIONAL GEOGRAPHIC MAGAZINE for December, 1911.

Photograph from U. S. Bureau of Fisheries

A HERD OF ALASKAN FUR-SEAL

After being sadly disseminated by indiscriminate slaughter at sea, the herd has been rapidly recuperating under the influence of an international agreement, and soon the fur-seals may be as numerous as when they came into the possession of the United States Government with the purchase of Alaska (see text, page 549).

variety, and excellence anywhere else in the world. They include the shad, alewives, smelt, striped bass, and perches of the Atlantic slope, and the salmons of the Pacific. The latter have been supplemented by the shad and striped bass, introduced from the east and now among the most abundant of the river fishes of the Pacific States.

Among the important strictly freshwater fishes, first place must be given to the trout, whitefish, herrings, and pike perch of the Great Lakes, and to the basses, catfishes, buffalo-fishes, suckers, and carp of the interior waters generally. The last-named fish, introduced into Europe from Asia some centuries ago and brought to America from Europe about 1876, has become the most widely distributed, most abundant, and most important single fish of the fresh waters of America.

MOST ABUNDANT ECONOMIC FISH OF ATLANTIC SEABOARD

The most numerous fish of economic importance on the east coast of the United States is the menhaden, which is known also by a large number of other names, some of them inappropriate and misleading. It is a member of the herring family; goes in great schools in the ocean, bays, and sounds, and supports a fishery from Maine to Florida.

Although the menhaden is a palatable food fish, its principal value now, as in the past, is for conversion into oil and fertilizer. At times it is exceedingly fat, and yields a cheap grade of oil much used in the industries, while the part remaining after the extraction of the oil is rich in ammonia and is one of the best fertilizers, whether employed alone or in combination with other ingredients.

The great abundance of the menhaden, its wide distribution on our coast, and its peculiar properties led many years ago to the establishment of an industry which soon became, and continues to be, one of the leading branches of the fisheries. In addition to the major uses referred to, large quantities are utilized as bait in the line fisheries for cod, mackerel, bluefish, and other fishes, and insignificant numbers are used as human food.

The chief purpose, however, which the menhaden serves is as food for numerous valuable fishes along the entire coast. It forms at times the principal diet of bluefish, swordfish, squeteague, bonito, mackerel, Spanish mackerel, etc., and often when we eat these fishes we are really consuming transformed menhaden. The abundance or scarcity of menhaden in a given season or on a given part of the coast may determine the abundance or scarcity of various important food fishes; and for this reason, in addition to its immediate value to man, it has by some persons been regarded as the most important fish on the Atlantic coast of the United States.

For many years the menhaden fishery has been the subject of much discussion and local opposition. In the opinion of many people, the catching of enormous numbers each year by means of purse seines has a tendency to make scarce the fishes which prey on the menhaden, and thus injury is done to other fisheries, particularly those carried on with lines by professional fishermen and sportsmen.

It is impossible to discuss this important question properly within reasonable space limits, and it will suffice to state that while the quantities of menhaden caught by man are insignificant by comparison with those consumed by other animals; while it may be unsafe to ascribe the scarcity of any food fish in a given year or locality to the effects of the menhaden fishery, inasmuch as some of our most important fishes are known to have exhibited periods of scarcity before the menhaden fishery was inaugurated, and while it is improbable that the operations of the fishermen have had any permanent influence on the abundance of the menhaden, nevertheless there is reason to believe that the presence of desirable food fishes in certain waters may be materially affected by the capture therein of large quantities of menhaden, and the fishery for the latter species should therefore be subject to Federal or State legislation.

Some idea of the abundance of menhaden and the magnitude of the fishery may be gathered from the fact that in 1913, when the Bureau of Fisheries made a special investigation and a statistical

GOVERNMENT SPAWN-TAKERS AMONG THE GLOUCESTER, MASSACHUSETTS, COD FISHERMEN

A very trying life, full of danger and exposure. At the Gloucester hatchery many hundred million eggs of cod and other valuable commercial food fishes are taken every year from fish that have been caught for market and whose eggs would be entirely lost except for the operations of the Bureau of Fisheries.

canvass of the industry, more than one billion fish were caught and converted into over six and a half million gallons of oil and nearly ninety thousand tons of fertilizer, valued at three and a half million dollars. These fish, if placed end to end, would have extended in an unbroken line six times around the earth at the Equator, and their weight exceeded that of all the inhabitants of Greater New York.

OUR UNSURPASSED SHELL-FISHES

There is no stretch of coast along the many thousand miles of shoreline of our mainland and islands, from Passamaquoddy Bay to the Rio Grande and from the Mexican boundary to the Gulf of Georgia, including all bays, sounds, and estuaries, that does not support some form of valuable crustacean or mollusk. Among the most prominent are the lobster of the North Atlantic coast, the spiny lobsters of Florida and California, the small blue crab of the Middle and South Atlantic and Gulf waters, the great crabs of the Pacific States and the shrimp and prawn of the Gulf of Mexico and California.

By far the most valuable of these is the lobster, which supports a fishery from Maine to Delaware and is the principal means of livelihood in many New England communities. For many years the fishery has presented the striking anomaly of an annually declining output and an annually increasing income to the fisherman. In the past quarter of a century the catch has decreased over 60 per cent, while the receipts of the fishermen have increased 200 per cent. The lobster, which because of its nutritious character

A GOVERNMENT SPAWN-GATHERER AT WORK ON A GLOUCESTER FISHING SMACK

While most of the spawn used in government cod propagation comes from fish kept for breeding purposes, this has to be supplemented by that gathered from fish caught by the commercial fishermen.

should be a staple food, has for years been a luxury, and every season the price to the retail consumer becomes more prohibitive.

The reasons for the diminishing supply are well known and may be summed up in a few words: disregard for the future, neglect of natural laws, and indiscriminate fishing. The situation demands radical action on the part of the States, and the welfare of the general public must be placed ahead of the temporary gain of fishermen.

The mollusks which figure most prominently in the fisheries and enter most largely into our dietary are the hard-shell clam, or quahog, known as the "little neck" when young; the soft-shell clam, or maninose, extensively used as bait in the New England line fisheries, in addition to being a highly prized food; the small and the giant scallops; the sea-mussel; the abalone, peculiar to the Pacific coast and more valuable for its brilliantly colored nacre than as an article of diet for occidentals; the squids, eaten by Asiatics and by the people of southern Europe, but used mostly for bait in line fishing, and, most important of all, the oysters of the eastern and western seaboards.

Throughout a vast area in the interior of the country there occur numerous species of mussels, or fresh-water clams, which have no utility as food, but because of their pearly nacre are in great demand for their shells. A very extensive industry, of comparatively recent origin in the United States, is based on the utilization of these shells for making buttons (see p. 563). These same mussels produce the only valuable pearls found in our waters.

Photograph from U. S. Bureau of Fisheries

SAVING THE NEW ENGLAND LOBSTER FISHERY

These men are bringing egg-bearing lobsters to the hatchery at Boothbay Harbor, Maine. The Bureau of Fisheries, in coöperation with the State authorities, collects egg-bearing lobsters from the fishermen, takes the lobsters to the hatcheries, and saves all the eggs, which would otherwise be lost. The mother lobster carries her eggs externally for ten months, and if caught at any time during that period her entire progeny is sacrificed unless her eggs are safeguarded by the lobster culturist. The lobster's eggs are about one-eighth of an inch in diameter and from 10,000 to 15,000 are produced by an average lobster.

A LOAD OF EGG-BEARING LOBSTERS

These lobsters have been collected from the fishermen and are being taken to the hatchery, where their eggs will be removed by gentle scraping with a dull knife

AMERICA PREËMINENT IN OYSTER PRODUCTION*

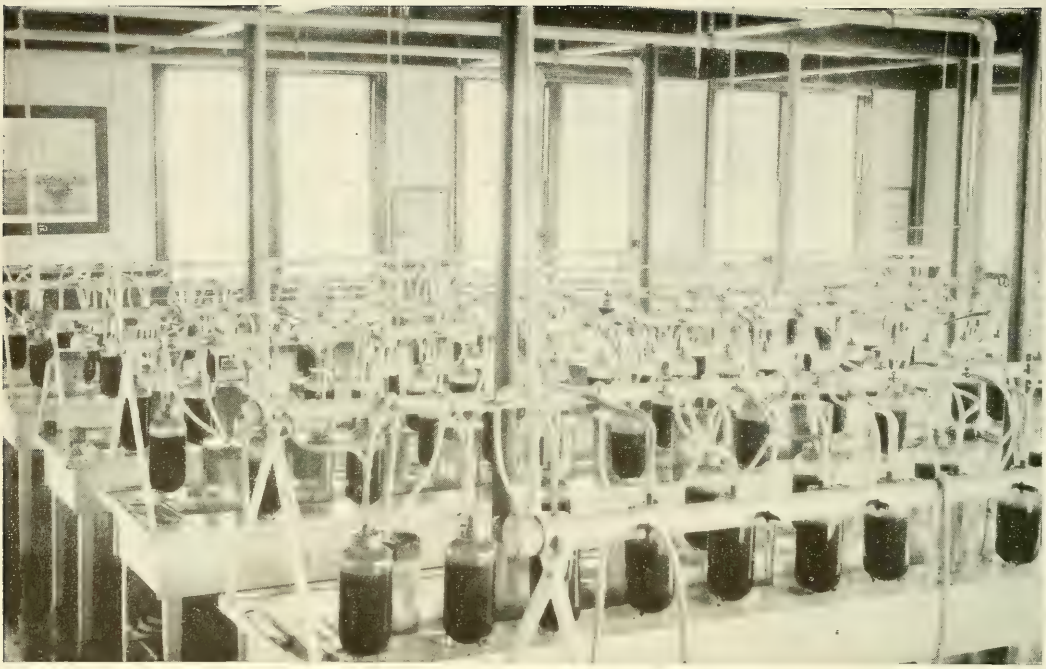
Among the fishery products in which America is preëminent, the most conspicuous is the oyster. This, our most important aquatic resource, is not only more valuable than in any other country, but more valuable than in all other countries combined.

The American oyster has the further distinction of being a staple food of comparatively low price, while in practically every other country having a well-developed oyster industry the oyster is a high-priced luxury. Its commanding position is shown in the facts that it is a commercial commodity in every coastwise State except two (Maine and New Hampshire); that it is the leading fishery product in fifteen States, and that it is the most extensively cultivated of all our aquatic animals. The annual oyster crop of the United States is about 35,000,000 bushels.

The yield is increasing yearly, and in some States is capable of great expansion, while in a few States the limit of production has nearly been reached. The seven leading oyster States are Rhode Island, Connecticut, New York, New Jersey, Maryland, Virginia, and Louisiana. Virginia and Maryland have the largest output, while New York and Connecticut have the largest money returns. The body of water which produces more oysters than any other in the United States, or, in fact, the world, is Chesapeake Bay. Other important regions are Narragansett Bay, Long Island Sound, New York Bay, and Delaware Bay.

The early rank taken by our oysters,

* See "Oysters—the World's Most Valuable Water Crop," by Hugh M. Smith, NATIONAL GEOGRAPHIC MAGAZINE, March, 1913.



Photograph from U. S. Bureau of Fisheries

TWO HUNDRED MILLION LOBSTER EGGS INCUBATING IN THE AUTOMATIC HATCHING JARS AT A NEW ENGLAND LOBSTER STATION OF THE U. S. BUREAU OF FISHERIES

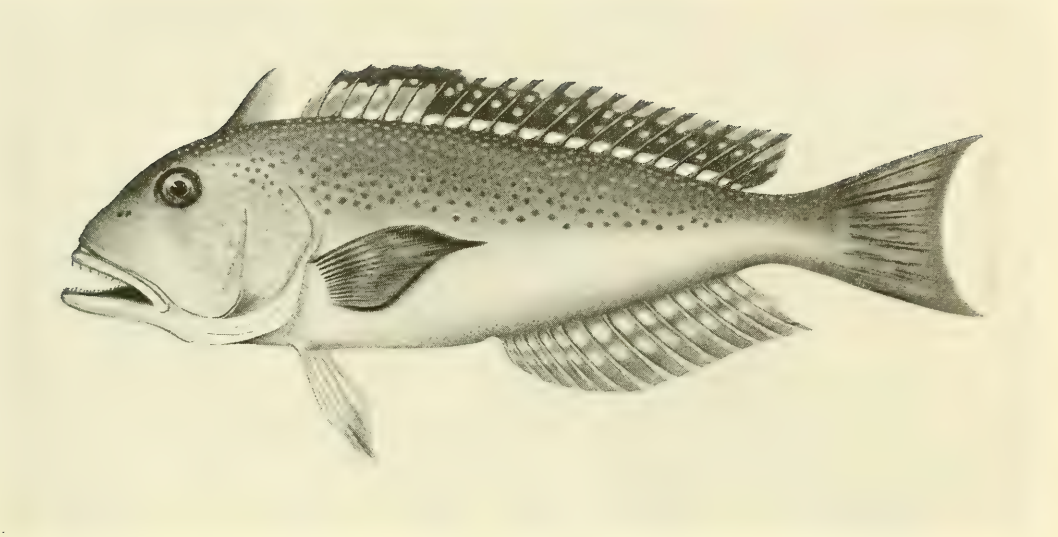
aside from their excellent flavor and large size, was due chiefly to the vast area of the oyster beds. The maintenance of that rank, however, has depended on oyster culture. Whenever the oyster fishery has been active, the necessity for artificial measures to maintain the supply has sooner or later become obvious, and at present about half a million acres of bottoms covered by salt or brackish water are being cultivated as oyster farms.

Although about 50 per cent of the quantity and 70 per cent of the value of our annual oyster crop are derived from planted grounds, and such product is larger than in all the remainder of the world, it is a significant fact that in no other important oyster-producing country is so large a proportion of the oyster output derived from natural beds.

Some of the States have only slowly appreciated the advantages that accrue from oyster farming and have been loath to abandon principles of oyster management that long since became obsolete. The welfare of their oyster industry has thus been greatly impaired, while more progressive States have reaped large benefits from the general adoption and encouragement of private oyster planting instead of continuing to depend on the diminishing output of depleted natural beds.

Oyster culture as practiced in America consists essentially of the following features: (1) Acquiring from the State, by lease or purchase, suitable submerged bottom; (2) cleaning and otherwise preparing that bottom, if necessary, for the growth of oysters; (3) sowing thereon oyster shells or other similar material, technically known as "cultch," for the attachment of the young oysters; (4) insuring the set of "spat," or larval oysters, by having adult oysters on contiguous bottom; (5) protecting the beds from starfishes, drills, and other natural enemies; (6) transplanting the oysters to prevent overcrowding and to facilitate growth and fattening, and (7) culling and sorting for market.

The United States Government, through the Bureau of Fisheries, while exercising



THE "TILEFISH," LATELY INTRODUCED TO THE AMERICAN DINNER TABLE

The tilefish first came to the attention of science in 1879. Three years later the Gulf Stream, with its warm water, drifted off of the continental shelf in tilefish territory, with the result that perhaps a billion and a half members of the species died, literal victims of a cold wave (see text, page 570).

no jurisdiction over the oyster grounds, has done much to promote the industry. The assistance rendered has taken various forms and has included studies of the oyster's life history, on the accurate knowledge of which protection and cultivation must depend; surveys of grounds on which oyster planting may be conducted, thus increasing the output and at the same time affording a larger revenue to the States from the sale or lease of such grounds to prospective farmers; experimental and model planting operations, often in regions where no oyster culture was previously conducted; recommendations for oyster legislation, and disinterested expert advice on the various problems that arise in the administration and practical conduct of the oyster industry.

ALASKA'S ENORMOUS FISHERY WEALTH

The salmon resources of the Pacific States are among the natural wonders of the Western Hemisphere, but they now take rank after those of Alaska, whose fisheries as a whole have experienced their remarkable development and attained their present surpassing importance chiefly because of the salmons.

Since Alaska became a part of the national domain, the total value of the products taken from the waters of the territory up to the present year has been nearly $300,000,000; the fishery reached its climax in 1915, with a value of $21,000,000, which is three times the purchase price of Alaska. Included in the foregoing aggregate are the very considerable sums accruing from the fur seal; but the bulk of the output represents the salmons, with cod, halibut, and herring completing the list of important fishes.

The halibut fishery of Alaska is far more productive than the halibut fishery of the Atlantic coast ever was, even in its palmy days; and it, with the fisheries for cod and herring, is capable of much further development.

The weight of the salmons taken in Alaska in 1915 was about 400,000,000 pounds. If this catch could have been placed in barrels holding 200 pounds each and the barrels piled end on end, the height of the column would have been about 1,200 miles! Or if the catch had been loaded into ordinary freight cars, a train of 10,000 cars would have been required and the length of the train would have exceeded 100 miles!

Photograph and copyright by Detroit Publishing Co.

A FLAKE YARD: GLOUCESTER, MASSACHUSETTS

Salted cod and other ocean fishes are fully cured by drying in the open air, and are then converted into "boneless" fish in numerous establishments on the water front of this old town

PLANTING THE WATERS

To compensate for the vast quantities of food fish taken annually from the coastal and interior waters of the country, the Federal Government conducts very extensive operations in artificial propagation, coöperating with the various States which are engaged in similar work or acting alone in the many States which have no hatcheries of their own. The States which maintain fish hatcheries number about twenty.

The year ending on June 30, 1916, was the most successful in the history of government fish culture in America. About five billion food and game fishes were brought into being under Federal auspices and distributed where they would do the most good. So comprehensive and well organized has this work become that the egg-collecting and hatching operations were conducted in 32 States and Alaska, and the output reached the waters of every State and Alaska.

The major fish-cultural efforts are directed to the cod, haddock, pollock, flounder, and lobster of the New England coast; to the salmon, shad, striped bass, white perch, and yellow perch of the streams of the Atlantic seaboard; to the whitefish, trout, and pike perch of the Great Lakes; to the salmons of the Pacific streams, and to the numerous trouts, basses, and other food and game species of the interior waters.

Distributions in public waters are made on the initiative of the government or on the recommendation of the State authorities; but the fishes adapted for ponds, smaller lakes, and minor streams are for the most part consigned on individual applications and are supplied without cost.

In moving the hatchery output to the points of deposit, specially constructed railway cars, with expert crews, are required, and in 1915 about 640,000 miles of railway travel by cars and detached messengers was needed for the distribution.

The fish-cultural work is so popular throughout the country, and the demand for fish for stocking public and private waters is so great, that new hatcheries are established by Congress from time to time, and a bill recently reported favorably to the House of Representatives provides for eighteen additional hatcheries to enable the Bureau of Fisheries to increase its operations in old fields and to extend its activities into new territory.

RESCUE OF FISHES FROM OVERFLOWED LANDS

An important adjunct and outgrowth of the hatchery operations is the rescue of fishes from the flooded lands in the valleys of the Mississippi and some of its tributaries. When these rivers overflow their banks and extend into the adjacent cultivated and waste places, as they do every year, they carry with them all kinds of food fishes. When the floods begin to recede, many of the older fishes find their way back to the streams; but enormous numbers of mature and young fish are left in sloughs, pools, or ponds, which gradually become dry, and the death of all the contained fishes follows as a matter of course; or, if the floods come late in the season and the stranded fishes do not perish from evaporation and seepage of the water, the same result ensues when the shallow pools become covered with ice.

This inviting and important field is entered by the Bureau of Fisheries with numerous crews of fishermen equipped with seines for catching the fish and with receptacles for holding them until they are returned to the parent streams or supplied to applicants in the contiguous territory. The rescue operations are conducted from Minnesota to Mississippi, and the food and game fishes saved every year run far into the millions.

HOW SCIENCE AIDS THE FISHING INDUSTRY

The general public is often restive and sometimes captious when any Federal bureau engages in scientific work to which there is no direct and obvious practical application or from which immediate economic results do not inevitably come. This attitude is reflected upon and responded to by members of Congress, so that it is usually difficult to secure financial support for the inauguration of scientific investigations or for their contin-

A HARD-SHELL CRAB CONVERTING ITSELF INTO A SOFT-SHELL

The difference between a hard-shell and soft-shell crab is simply one of time. Every now and then the crab needs to grow a little, so its body gets soft and its hard shell splits open. It is then enabled to pull itself out of that shell and to grow while a new one is in the process of forming. When this process is completed, it ceases to be a soft-shell crab and once more joins the ranks of the hard-shells. This change takes place several times a season.

uance unless some practical outcome is shown or reasonably sure of accomplishment.

Fortunately, the Bureau of Fisheries has from the outset been recognized as an institution whose scientific investigations and experiments lead to important practical ends, and the liberal appropriations for this purpose made by Congress year after year are an evidence of the way in which the lawmakers regard this service.

Our artificial propagation of food fishes, which is the most extensive work of the Federal fishery bureau, has reached its present proportions and efficiency entirely through the application to hatching and rearing methods of biological knowledge of the spawning, development, and general natural history of each of the fishes handled—knowledge that has depended on painstaking, long-continued field investigations.

Photograph and copyright by Keystone View Co.

"PICKING" CRABS FOR MARKET ON THE SHORE OF CHESAPEAKE BAY, MARYLAND

The principal crab fishery of the country is in Chesapeake Bay. In 1915 over 15,000,000 crabs were caught in that body of water and sold by the fishermen for about one million dollars. The picture shows the women "picking" the crab meat.

Feasible methods of cultivating aquatic creatures other than fishes, valuable as food or in the arts and industries, have been developed in order to maintain the supply or to save from commercial extinction. Among the conspicuous achievements under this head have been the perfecting of ways and means of rearing the lobster and the diamond-back terrapin and of growing sponges from cuttings. Especially noteworthy has been the development of the oyster-planting industry, as a result of recommendations to the States following surveys of the oyster grounds and barren bottoms.

One of the large tasks which the bureau has set out to accomplish is the perpetuation of an industry in the Mississippi basin, worth $8,000,000 to $10,000,000 annually, by assuring the permanency

Photograph and copyright by Keystone View Co.

UNLOADING OYSTERS FROM THE HOLD OF A CHESAPEAKE BAY SCHOONER: BALTIMORE

Chesapeake Bay is the leading oyster ground of the world, producing about one-third of the American product, while Baltimore is its foremost oyster market

of the supply of raw materials on which the business depends. A great laboratory has been established on the Mississippi River, at Fairport, in Iowa, and pioneer studies and experiments have there been in progress to determine how the pearly mussels may be artificially increased, so that the many factories making buttons therefrom may not have to shut down following the exhaustion of the mussel beds by unregulated fishing.

An entirely new problem in aquiculture was here presented, and has now been satisfactorily solved through the discovery of the fact that the young mussels, while still in a microscopic larval stage, must attach themselves to the gills of particular fishes in order to develop, and that unless the fishes for which the different kinds of mussels have a selective affinity are available none of the young will survive.

Photograph and copyright by Keystone View Co.

A MOUNTAIN OF OYSTER SHELLS READY FOR PLANTING: OYSTER CULTURE, HAMPTON, VIRGINIA

An essential of oyster farming is to spread on the bottom clear material for the attachment and temporary support of the young oysters. When first hatched, they are free-swimming, microscopic creatures, but in a few hours they fall to the bottom and are lost unless they can adhere to a firm, clean surface while making their shells and undergoing development.

The fish hosts of the various important button-making mussels have been determined, and it is the province of the laboratory to provide those fishes and have them inoculate themselves by swimming in tanks or ponds in which the spawning mussels have been placed.

When a fish is sufficiently infected, it is turned loose in the river, and in a few weeks the young mussels, having attained a proper development, become detached from the gills, fall to the bottom of the stream, and begin their independent existence.

BIRD'S-EYE VIEW OF A GOVERNMENT TROUT AND GRAYLING HATCHERY IN MONTANA

OPEN-AIR TROUGHS FOR REARING ATLANTIC SALMON AT A HATCHERY ON THE PENOBSCOT RIVER, IN MAINE

The Penobscot is the only river on our Atlantic coast which continues to have a regular run of salmon, although in early times many streams were visited annually by schools of this fish. The maintenance of the salmon supply in the Penobscot, notwithstanding adverse physical conditions, is due entirely to artificial propagation.

INTERIOR OF A WHITEFISH HATCHERY, SHOWING PECULIAR ARRANGEMENT OF THE JARS IN A "BATTERY"

This arrangement economizes space and water and is used throughout the Great Lakes region, where very large numbers of eggs are handled

About 350,000,000 baby mussels were thus inoculated on fishes in 1915 at the Fairport station, and buttons have actually been made from the shells of mussels that had been grown from the larval stage in the laboratory ponds.

FASHIONS IN FISH LIKE FASHIONS IN CLOTHES

For some years the Bureau of Fisheries has been conducting experiments to show the potential value of aquatic resources that are either wholly neglected or only inadequately utilized in the United States, and has inaugurated several campaigns to induce our people to eat new fish and other water products. This is one of the most important services that can be rendered to a nation, and the success of some of these efforts has encouraged the hope and belief that results of large economic significance may be obtained from various other articles to which fishermen, dealers, and the public are now indifferent.

There are fashions in fish just as there are fashions in clothes. The American public has from the beginning been fastidious and fickle in its tastes for aquatic foods and has been loath to accept articles which other countries long ago adopted as staples.

PICKING OUT BAD EGGS IN A MICHIGAN TROUT HATCHERY

Many millions of lake-trout eggs are here incubated, and the trays containing the eggs have to be carefully examined daily in order to remove the dead ones, which, if left in contact with those that are sound, would impair their vitality or communicate disease to them. The "deads" are picked out with tweezers by a body of trained girls temporarily employed for this purpose.

A FISH-DISTRIBUTING CAR BEING LOADED FOR A TRIP

There are more than 6,000,000 farms in the United States. If there were a fish pond on every farm and each family took only three pounds of fish a week, more than a billion pounds of extra food a year would be secured, releasing a corresponding amount of other meat for city consumption, and consequently having a reflex upon the high cost of living.

GOVERNMENT MESSENGERS PLANTING FISH

Before transferring fish from cans to an open stream, it is necessary gradually to bring the water in the cans to the approximate temperature of that in the stream; otherwise the fish will experience a shock.

The great wealth of our waters has made it possible for our people peremptorily to discard much and to choose the best, or what they regarded as the best; and the early development of the fisheries has been characterized by the rejection of wholesome aquatic products that have now taken a prominent place in the market after years or generations of neglect or disrepute. In fact, in every important fishing region people are still living who recall the time when ignorance and prejudice placed a ban on certain aquatic foods which have since become valued commodities in the identical sections where they were formerly condemned or ignored.

Among the well-known examples of water resources that were once wholly or largely neglected, but are now extensively utilized, or are beginning to be more generally appreciated, are the haddock and the winter flounder on the north Atlantic coast; the tunny, the shad, and the minor salmons of the Pacific seaboard, and the sea mussel of New England.

Especially noteworthy has been the recent establishment of a tunny fishery and a very extensive tunny canning industry in southern California. Of the hundreds of thousands of people who now regularly eat the delicious canned "tuna," few realize that a few years ago not a single fish of this species was utilized in America, and that our entire supply came from the Mediterranean.

Another conspicuous case has been the recent development in southern New

PICKING EGGS AT THE GRAND MESA FIELD STATION, COLORADO

The Bureau of Fisheries maintains upward of one hundred field stations, some of the most important being in Colorado. The eastern brook trout, originally introduced into Colorado from New England, is now more successfully propagated there than in any other State, and is being sent back east in large numbers to replenish Atlantic seaboard streams.

England of a very important fishery for the winter flounder carried on with trawl nets. Formerly only comparatively small quantities of this fish were caught for market, but now millions are taken annually, and thousands of fishermen are making a livelihood in this new fishing industry.

The Bureau of Fisheries long ago called attention to the value of this fish and began its artificial propagation, so that at present, the methods of culture having been perfected, the government is producing a billion or more young flounders each year and planting them in the regions where the fishing is most active.

THE CASE OF THE SEA MUSSEL

A noteworthy case of neglect, followed by appreciation and utilization, is that of the sea mussel, one of the best and most abundant of marine foods. Hundreds of millions of pounds are eaten annually in western Europe, but in the United States practically the only use made of them has been for fertilizer and bait.

In 1914 an advantageous opportunity was presented for introducing this mollusk in one of the prominent Boston hotels, and through the assistance of the newspapers the experiment attracted so much attention that within a few months mussels were, for the first time, being served and given a conspicuous place on the menus of over seventy of the principal hotels, clubs, and restaurants of Boston. The demand naturally spread to private houses and to adjacent communities, with the result that the mussel has become a regular commodity of the

GETTING FISH FOOD FROM A POND AT A MICHIGAN HATCHERY

Young trout and bass subsist naturally on small crustaceans and other living creatures, and the best and hardiest fish are produced when the fish-culturist is able to supply this natural food.

region, to the benefit of consumer, dealer, and fisherman; and the knowledge of the food value of the mussel has gradually extended to other cities, and its regular consumption over a wide area, both adjacent to and remote from the seaboard, is assured.

That a very extensive mussel fishery will be developed on our Atlantic and Pacific coasts is inevitable. Mussels occur in vast beds as yet untouched and easily reached by tongs and dredges. They are as nutritious as oysters and clams, and, their shells being thinner, a given quantity contains more actual food than does the same bulk of oysters.

A further advantage is that they are in season at all times and are at their best on the New England and middle Atlantic coasts when the oyster supplies in the markets are most reduced, namely, in summer.

The most advertised fish in the United States during the past eight months has been the tilefish. The advertising was undertaken by the Bureau of Fisheries in order to make known to the public an abundant, palatable, and neglected food fish occurring on the east coast of the United States in a region readily accessible to the principal markets. The fact that an astonishing amount of interest was thus aroused depended in part on the merits of the propaganda and in part on the romantic and tragic history of the tilefish.

THE ROMANCE OF THE TILEFISH

The tilefish holds an absolutely unique place in nature, science, and industry. So far as records go, no person had ever seen a tilefish prior to May, 1879, when Captain Kirby, fishing in a Gloucester schooner south of Nantucket, caught in deep water several thousand pounds of a

A PACK-TRAIN OF HORSES LADEN WITH CANS OF YOUNG TROUT FOR PLANTING IN A COLORADO LAKE

The jolting of the cans is of advantage to the fish, as it serves to aërate the water

"strange and handsomely colored fish." He sent a specimen to the United States Fish Commission, of which the present Bureau of Fisheries is the direct descendant, and ichthyologists in that establishment discovered it to be new to science and named it *Lopholatilus chamæleonticeps*. A less worthy fish might never have been able to attain popularity under such a handicap name, which, being interpreted, means simply the tufted chameleon-headed tilus. A short name, adapted for common use, was obviously needed, so the sponsors for the new species perpetrated a pun on a syllable of its generic name and called it "tile" fish.

The Commissioner of Fisheries at that time, Prof. Spencer F. Baird, at once began investigations to determine the location and extent of the grounds on which the tilefish occurred, the abundance of the fish, and the possibility of establishing a commercial fishery.

In less than three years, however, and before the plans of the Commissioner were completed, the tilefish met with a cataclysm which resulted in its apparent extermination. News of the disaster was brought in by the master of a ship in March, 1882, who reported that he had sailed for 69 miles through dead and dying tilefish that thickly covered the surface off the middle Atlantic coast.

Various other reports to the same effect were received in March and April, and it was computed that an area 170 miles long and 25 miles wide was covered with dead fish, whose number was estimated at 1,400,000,000. No such catastrophe had ever befallen any other fish in the history of the world and speculation as to its cause was rife.

The Bureau, through its investigations before and after the event, was able to offer an explanation which has been generally accepted. The tilefish, while a bot-

RESCUING FISH FROM A MISSISSIPPI RIVER SWAMP

On June 1, 1915, this bayou covered 11 acres, and on November 15, 1915, it had wasted away to a pool 35 feet by 50 feet and 14 inches deep in the deepest part. Some of the fishes had been seined out earlier in the season, but on the final clean-up 150,000 were rescued and removed to open water. They comprised more than ten species of food and game fishes, including 30,000 catfish, 15,000 crappie, 25,000 sunfish, and 15,000 buffalo-fish.

PLANTING FISH IN THE OPEN WATERS: A RESCUE PARTY ON THE MISSISSIPPI

Fish not wanted for distribution to applicants are transferred in tubs and liberated in the open river

tom species, inhabiting moderately deep water, was, unlike most bottom fishes, a lover of warm water and found congenial haunts on a narrow strip where the Gulf Stream touched the edge of the continental shelf. There is evidence to show that about the time in question the Gulf Stream was receding, or moving offshore, and that its warmth eventually ceased to bathe the bottom frequented by the tilefish, which therefore came under the influence of a cold inshore current that took the place of the Gulf Stream. Being unable to adapt itself to the new conditions or unable to find new grounds where the depth and temperature were congenial, the tilefish in reality succumbed to a cold wave.

U. S. FISHERY STEAMER "ALBATROSS" AT ANCHORAGE IN RESURRECTION BAY, ALASKA, WHILE ENGAGED IN INSPECTION WORK

The United States annually takes from the waters of Alaska fish valued at more than three times the price we paid for that wonderful territory (see text, page 557)

Some years later, when the Gulf Stream was still "off soundings," investigation showed that it was approaching the coast, and the prediction was made that about 1892 it would again be flowing over the grounds on which the tilefish had once abounded.

The prediction was verified, and it is noteworthy that in the year named, after ten years of persistent search, during which not a single specimen was found, the Bureau's schooner *Grampus* caught a few tilefish in the old haunts. Evidently a remnant had survived, probably far to the south, and the fish had gradually worked back to the region formerly frequented. From that time on the species quickly reëstablished itself and soon became apparently as numerous as ever, so that today it occurs in great abundance along the 100-fathom line from a point south of the Nantucket Shoals lightship to a point southeast of Atlantic City and possibly much farther south.

Believing that the food qualities, accessibility, and abundance of the tilefish warranted an attempt to establish for it a commercial fishery, the Bureau of Fisheries, in October, 1915, undertook the triple task of inducing the fishermen to catch the fish, the dealers to handle it, and the public to buy and eat it.

So successful were these efforts that, within one month of the date when the demonstration was begun, the Bureau was able to withdraw from the field and turn the project over to the commercial interests. A regular fishery has been inaugurated by Massachusetts, New York, and New Jersey vessels, of which more than twenty have been engaged at one time; and up to June 1, 1916, or in less than seven months, over 1,700 tons of tilefish, yielding the fishermen more than $200,000, had been caught and sold, chiefly in New York City, whence the product has been distributed over a large area, extending as far west as Chicago

A 100-POUND HALIBUT CAUGHT BY THE U. S. S. "ALBATROSS" WHILE SURVEYING NEW AND LITTLE-KNOWN FISHING GROUNDS ON THE COAST OF OREGON

Large additions to the local food supply and good opportunities for the establishment of new fisheries have come from this work of the *Albatross*

Photograph from Henry O'Malley

A COLUMBIA RIVER SALMON WHEEL

Photograph from Henry O'Malley

NEAR VIEW OF A FISH WHEEL: COLUMBIA RIVER, OREGON

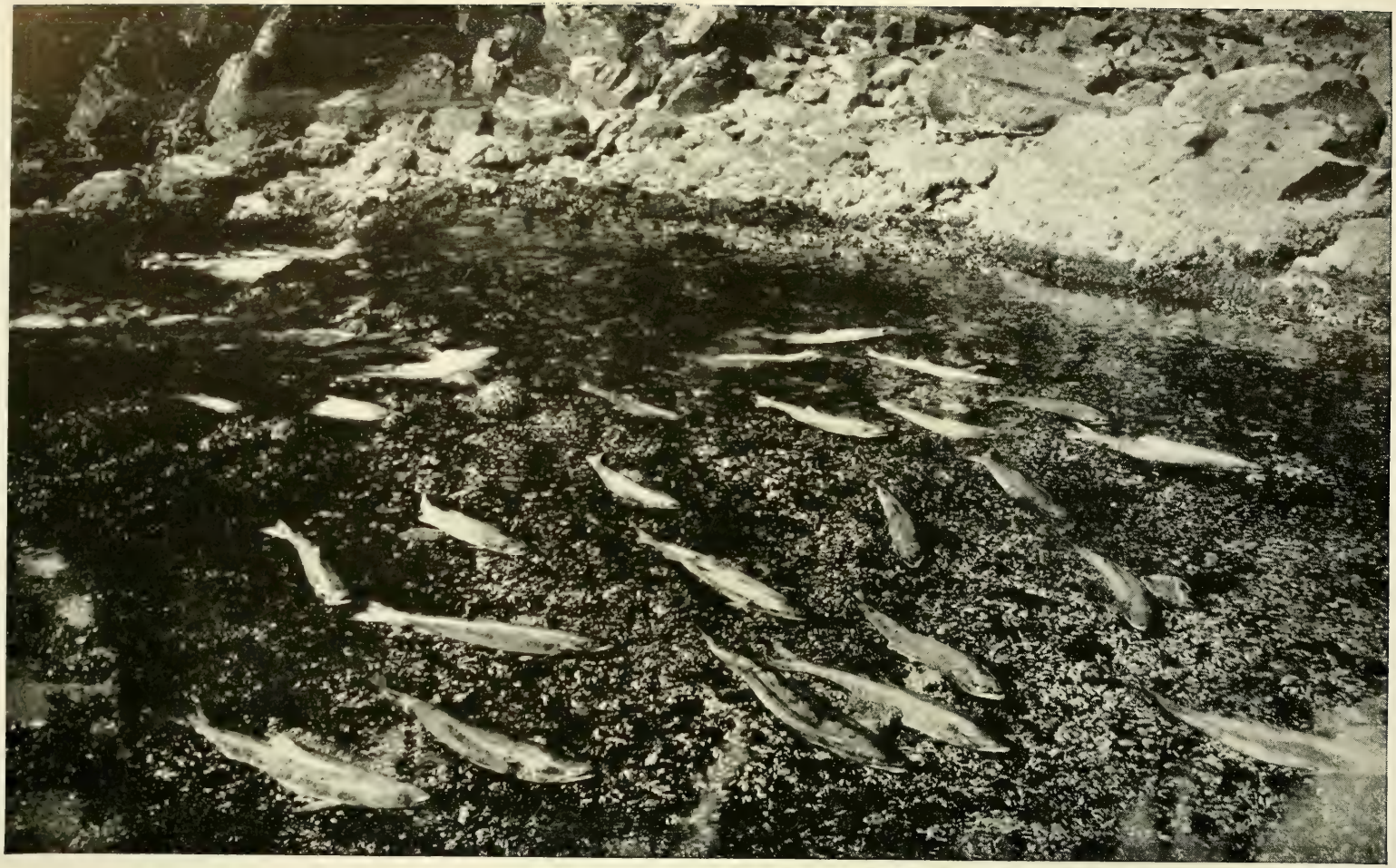
The salmon wheel reaches its highest perfection in the Columbia River, but is used also in parts of Alaska. It consists of a series of net compartments arranged in the form of a huge wheel, supported on a scow or on a crib-work, cement, or masonry base. The wheel can be used only in rapid water, as it is turned by the current and catches the fish swimming upstream. The above wheel, with a solid cement base, is operated at The Dalles.

and St. Louis and as far south as Atlanta.

AMERICA'S FUTURE SUPPLIES OF AQUATIC ANIMALS

Thoughtful people everywhere are asking the question whether our wonderful aquatic resources will continue without essential impairment and be an important source of food and wealth for generations yet to come, or whether the unmistakable decline which has befallen some of our most valuable products is but a forerunner of a condition to which all of our water animals are inevitably and speedily tending. We may profitably indulge in a little speculation regarding this question, with the history of the older nations to guide us.

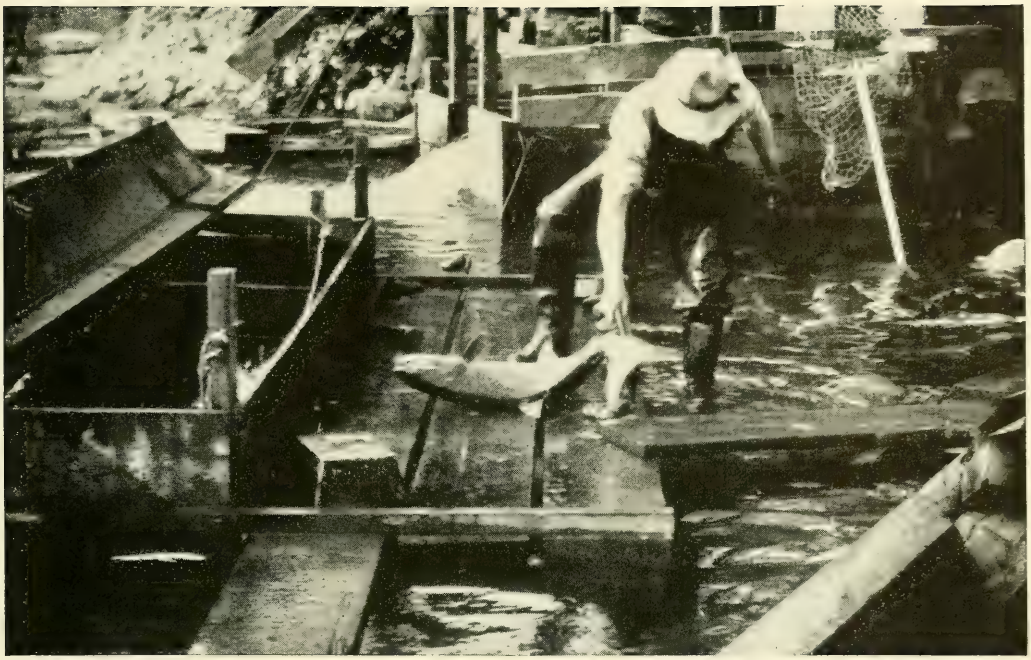
There is every reason to feel assured that our great high-sea fishing grounds will remain productive and continue to



Photograph from John N. Cobb

A REMARKABLE PICTURE OF SALMON SPAWNING ON A GRAVELLY RIFFLE IN A PACIFIC COAST STREAM

There are five species of Pacific salmons, and all of them have the remarkable habit of dying after once spawning. This applies to both sexes, and was a wise provision of nature to prevent overstocking. The only other American food fish with this habit is the common eel, which spawns and dies at sea.



Photograph by Shirley C. Hulse

GATHERING EGGS FOR GOVERNMENT HATCHING

The male fish ("bucks") are put alive in the floating box shown in the left of the picture. The females ("does") are stunned by a blow on the head, after which their tails are chopped off. This bleeds the fish, and, later, when they are ripped open and the eggs removed, no blood appears. Should any blood get in the eggs, they would not hatch.

support valuable fisheries, subject to seasonal or periodic fluctuations, such as have always characterized free-swimming oceanic fishes as far back as authentic records go. Periods of great scarcity, such as have come to the bluefish and the mackerel on the Atlantic coast of the United States and to the sea herring on the Atlantic coast of Europe, are to be expected, just as are periods of abnormal abundance, such as characterized the menhaden in 1913 and the swordfish in the western Atlantic for the past few years.

It may confidently be expected that our coastal waters will continue to contribute their large quota of fish, crustacean, and molluscan foods, provided the attitude of the various States toward their fisheries is helpful. Inasmuch as many of the most valuable animals inhabiting the coastwise waters may be very injudiciously affected by improper methods and inadequate regulation, it follows that the proper handling on the part of the States will maintain the supplies or restore depleted resources. Furthermore, a very marked increase in the abundance of fishes and shellfishes may result from the institution of wise cultural operations under State encouragement.

In the Great Lakes and the major streams the future output of fish will be governed very largely by adequate, uniform, or harmonious interstate or international regulations. The serious decline that has characterized some of the principal fisheries in these waters is directly attributable to the failure of the States to appreciate the non-local character of the fishery question; the restoration of the depleted resources and the maintenance of the supply hereafter will depend on the realization by the States that they cannot ignore the nation-wide aspects of the situation, and that they cannot legislate for themselves alone. Fish culture, however effective or potent, cannot, unaided, remedy a condition that it was unable to prevent.

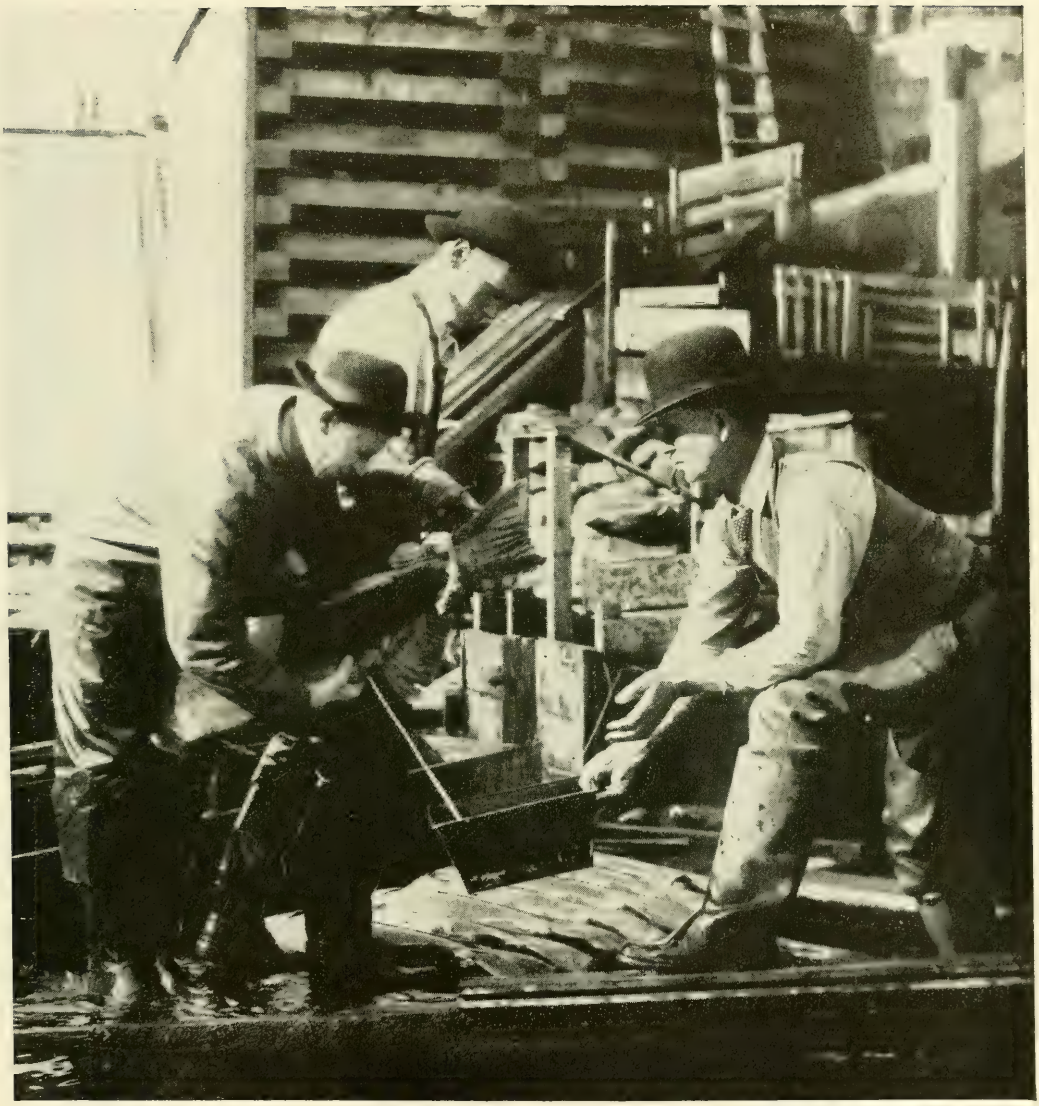
It is becoming more and more evident that, with the increase in population re-

Photograph by Shirley C. Hulse

BUCK SALMON CAUGHT AND HELD READY: OREGON

sulting in increased demands and with the injury to the fish life in streams resulting from obstructions and pollutions, the future fish supplies from our minor fresh waters must depend largely on cultivation, and that an important part of the fish consumed in suburban and country communities remote from the coast or large water-courses will result from private aquiculture

Already a very marked change has occurred in the natural productive capacity of many of the minor fresh-water streams and lakes, and further far-reaching



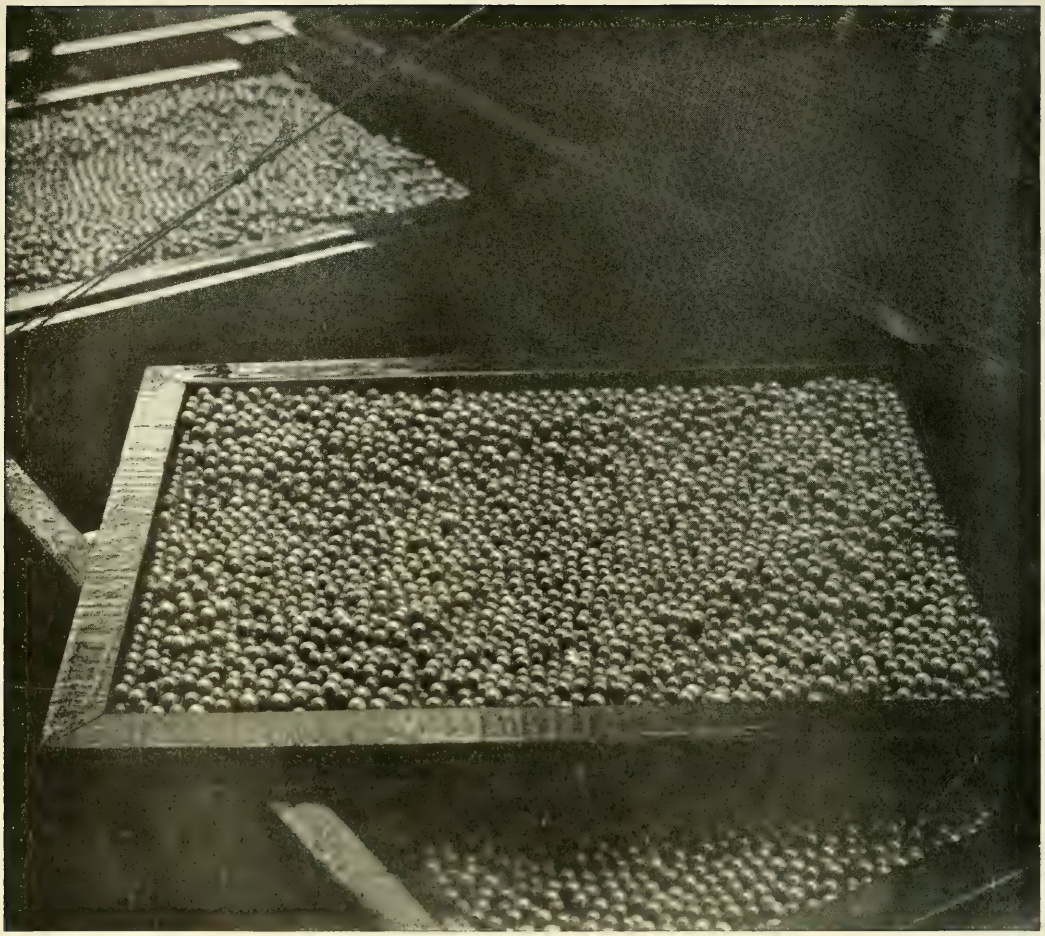
Photograph by Shirley C. Hulse

FERTILIZING THE SALMON EGGS: OREGON

It sometimes requires two men to handle a large buck. As soon as the "milt" is in the pan with the eggs, a little water is added and the whole stirred until the mass of eggs is thoroughly impregnated.

changes are imminent. Various streams, particularly on the Atlantic slope, have ceased to be reservoirs of fish life and have become mere vehicles for the discharge of factory and city refuse; other streams, owing to the creation of dams, long ago ceased to be available for schools of migratory fishes that formerly resorted to them every season.

These were premonitory and for the most part neglected signs of conditions that are gradually arising all over the country. It may be doubted whether our industrial development is incompatible with the preservation of the physical and biological characters of our streams; but the history of other countries and the precedents afforded in our own country clearly indicate that, when the time comes to decide, the fisheries have to yield to



SALMON EGGS ON TRAYS READY FOR SHIPMENT

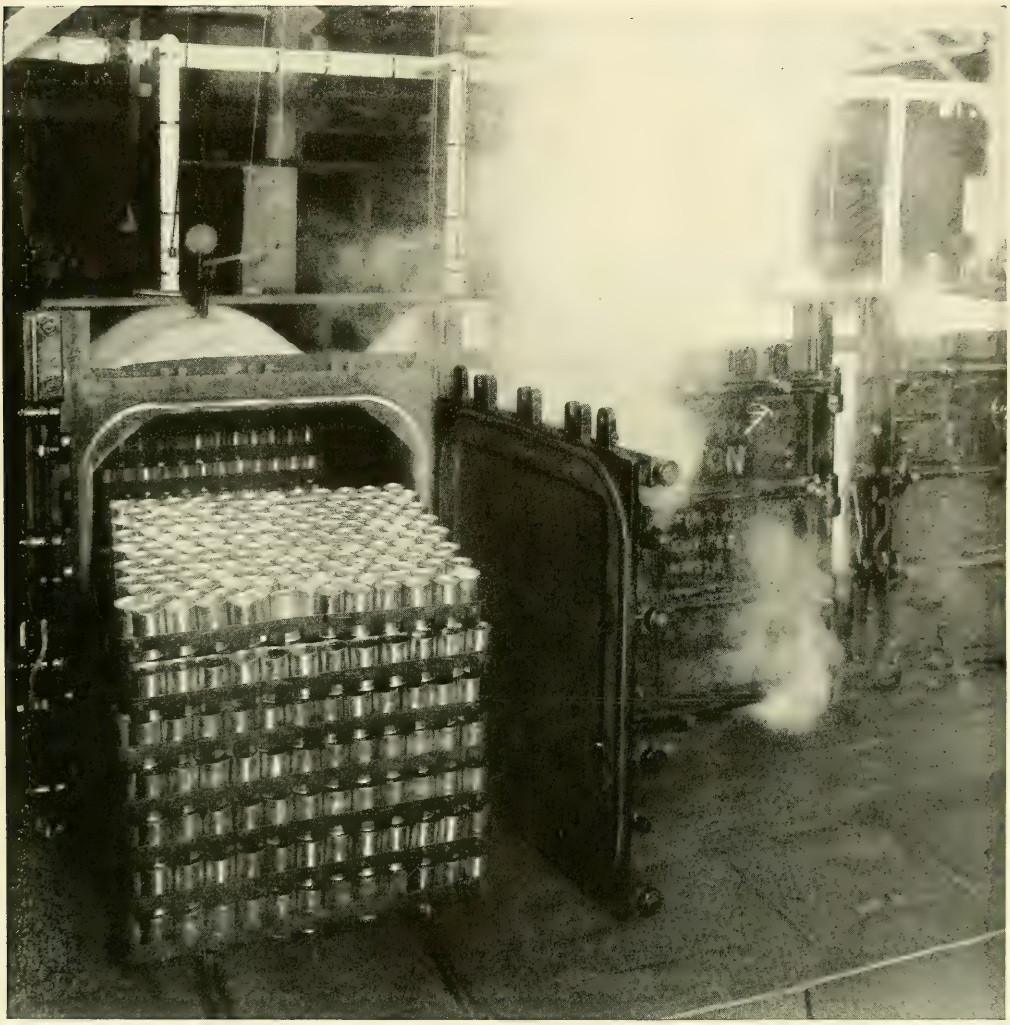
Eggs are packed in this manner for transfer between hatcheries and for distant shipment, as to foreign countries. The eggs packed in a case can, if kept cool and moist, remain out of water for several weeks without impairment. One hundred thousand eggs may be carried in a case.

what are adjudged more important interests.

The greatest problems that will hereafter affect the fish supply for a large part of the United States will be (1) how to replace or compensate for the large quantities of food that will have been cut off by the appropriation of waters for purposes incompatible with fish life; (2) how to make good the shortage in waters that continue to be overfished and have a declining yield, and (3) how to provide a fish food for the rapidly increasing population in regions having no major waters on which to draw.

The solution must be found in the general inauguration of private fish culture, which must necessarily reach its highest utility on farms and be conducted incidentally to the various branches of agriculture and animal industry.

A substantial start has already been made in this direction, and the Bureau of Fisheries has supplied hundreds of millions of artificially hatched food fishes for stocking hundreds of thousands of minor, private waters; but only a small proportion of the farms in the country are as yet equipped with fish ponds or fish lakes, and a great obligation now de-



Photograph by Curtis & Miller

A RETORT WHICH COOKS TWO THOUSAND CANS OF SALMON AT A TIME

Here they are given the final cooking under steam pressure. While large quantities of salmon are sold in a fresh, salted, or smoked condition, by far the major part of the catch is canned. In 1915 the pack of canned salmon in Alaska and the Pacific States exceeded 6,500,000 cases of 48 one-pound cans, valued at $30,000,000.

volving on the fishery service of the United States and of the various States is to make known the possibilities of private pond culture and to provide the necessary stocks of fishes suitable for different waters in different parts of the country.

The ample experience of private fish culturists in all parts of the country confirms the opinion often expressed by national and State fishery officials, that under given conditions aquiculture may be more profitable than agriculture; that an acre of the best water may yield larger returns than an acre of the best land, and that food supplies of untold volume and value may be expected from what are now unused waters.

COMMON AMERICAN WILD FLOWERS

In this number, pages 591 to 606, the GEOGRAPHIC MAGAZINE, *at very great expense, prints another series of colored pictures of Common American Wild Flowers. These exquisite paintings, as well as the subjects of the previous series, were drawn from life by Mary E. Eaton, of the New York Botanical Garden, the able director of which, Dr. N. L. Britton, has cordially coöperated in their preparation.*

In future numbers the GEOGRAPHIC *will present additional paintings of native wild flowers.*

No out-of-door interest brings to old and young richer returns in entertainment and instruction than is found in making the acquaintance of our wild flowers. Many of these, such as the daisy, mullen, aster, blue-flag, etc., are so plentiful that they may be picked at will; but there are others—for instance, the May-apple, spring beauty, lupines, lady's-slipper, etc.—which may become as rare as the trailing arbutus unless every one unites to preserve them. So it is to be hoped that the city dwellers who on their automobile excursions thoughtlessly cut and bring back great branches of dogwood and baskets laden with our rarer wood flowers will soon realize that, unless their plucking be tempered with judgment, the suburbs of all our cities will in the not-distant future be bereft of many of these flower treasures.

FORGET-ME-NOT (Myosotis scorpioides L.)

(See page 591)

The forget-me-not is a delightful immigrant belonging to that numerous family which includes the Virginia cowslip, hound's tongue, and comfrey.

The flowering season of this plant is from May to July. It came to us from Europe and Asia, and is now spreading from Nova Scotia southward along the Atlantic coast. It was led into captivity many centuries ago. As far back as we are able to trace flower history it held an honored place in the flower garden, and when America was settled, it was brought along to cheer the settler's austere life, and to remind him of the old roof-tree across the billowy sea.

The forget-me-not likes to play hookey from the flower garden, and to steal down to the brookside and meadow and live within earshot of the gurgling stream. With all that man has done for it, he has never bred out of it the spirit of independence that has been lost by most of the other flowers of the garden, for whenever opportunity affords, the forget-me-not yields to the call of the wild.

Have you ever noticed the little golden circle around the center of the flower? That little circle is put there by the flower as a honey guide, to tell the bee just where to insert her tongue to get the richest draught of nectar, and at the same time to touch both anther and stigma and thus fertilize the plant. And if you will watch the bees, you will discover that they are as careful to follow this signboard pointing to the well of nectar as a motoring tourist is to follow the signboard to the best hotel when night overtakes him.

There are many legends concerning the forget-me-not. Tennyson once wrote that it grows for happy lovers. Another writer tells us that once upon a time a young lover, trying to gather a bunch of these lovely blossoms for his sweetheart, slipped into the water and, as he was sinking, tossed the flowers to her and asked her to keep them and not to forget him.

VIRGINIA CREEPER (Parthenocissus quinquefolia (L.) Planchon)

(See page 592)

The Virginia creeper is a member of the grape family, cousin alike to the sour frost-grape of the woods and the luscious Concord of the vineyard. It has been called the false grape, although it is too fair a plant thus to be slandered by a name. No lover of the woodland will ever be made to believe that the Virginia creeper essays a rôle to which it is not entitled. Some people mistakenly call it the woodbine, but that name more properly belongs to another plant of the honeysuckle family.

Many people confuse the Virginia creeper with the rascally poison ivy, a confusion which nothing but carelessness in remembering the characteristics of plants could bring about; for the Virginia creeper is careful always to put forth five leaves where the poison ivy has only three (compare pages 592 and 593).

This graceful climber has traveled as far north as Newfoundland, as far south as Cuba, and as far west as the western part of the Mississippi Valley.

It lives true to its name, creeping on and on, securing a new foothold here and another there, sending out its tendrils as it grows. When one of these succeeds in arranging its branches so that they can press upon any surface, its curved tips swell and become bright red. On their undersides they form little disks or cushions, which attach themselves to the surface and afford a new foothold for the vine.

It is surprising how much weight one of these little disks can bear. Darwin tested their strength and found that one of them will stand a strain of two pounds, while five of them grouped together on a tendril can bear a weight of ten pounds.

What is more picturesque than the old-fashioned stone fence, or the stake-and-rider worm fence, with its load of green foliage in summer and its clusters of bright blue berries in the fall! Over fences, walls, and trees it rambles luxuriantly, and, while it seems to love its wild life best, it will gladly adopt one's very doorstep as its home, and welcome an opportunity to weave a curtain of living green over the sunny sides of the veranda.

In the autumn its blood-like sprays are outlined against the dark evergreens about which they twine, making a contrasting picture of rare beauty. The Virginia creeper has perhaps more honor abroad than at home, being widely cultivated in Europe. Even in Venice one may see it covering crumbling walls or gracefully clinging to carefully prepared trellises.

POISON OR THREE-LEAVED IVY (Toxicodendron radicans (L.) Kuntze)

(See page 593)

The poison ivy is a member of the sumac family, having as relatives the vinegar tree, the smooth sumac, and the smoke-bush. Its range reaches as far north as Nova Scotia, as far south as Florida and Texas, and as far west as Utah and British Columbia.

As described in the sketch of the Virginia creeper, it is often confused with that beautiful member of the clinging-vine clan. The Virginia creeper is condemned as being poison ivy oftener than poison ivy is accredited with being a Virginia creeper. Many a Virginia creeper has reached the untimely end of mattock execution by the error, and not a few people have received a painful reminder of their mistake when they have failed to observe that three leaves spell "foe" in the ivy vine and five leaves "friend."

The poison ivy, or poison oak, as some call it, is a prodigal climber, inclined to run over everything in sight. Even the oak sometimes is almost smothered when the poison ivy reaches its topmost branches and spreads its dense foliage over them.

It begins to blossom in May and June, its flowers being small, fragrant, yellowish green, and arranged in densely clustered spikes. Toward fall these develop into smooth, white, wax-like berries that often hold fast the winter through. The three leaves are shining green, short-stemmed, and oval-pointed.

The poison of this ivy is a powerful, non-volatile oil which penetrates the pores of the human skin and develops hosts of tiny itching blisters, followed by a burning swelling of the affected parts.

While we very naturally dislike a plant that poisons us when we touch it, yet if we investigate the reason for its poison we discover that a vast number of plants develop poisons and near-poisons, and when we look over the list we find that we would be rather badly off without them. It is true that most of them are poisonous only when eaten, and that few are poisonous to the touch, but they have all developed these qualities in self-defense.

Some of them store their poison in their seeds, others in their root-stocks, and others in their roots to protect their progeny from harm. They do not go about looking for trouble or seeking, like the devil, whom they may destroy; but they are prepared to resist invasion of the rights of their children. Nux vomica and aconite are two of many such illustrations that might be cited.

Others develop alkaloids, like the nicotine of tobacco, the quinine of the cinchona tree, and the theine of tea, to protect themselves. Strychnine, digitalis, and a hundred and one indispensable drugs that are poisonous in overdoses are the gift of the plant world to man as a by-product of plant preparations for self-defense (see also gentian, page 589).

And so, when the poison ivy learned to give off its poison by contact rather than through its own destruction, it simply went a step further than its neighbors. It has arranged its plans of defense, so that it can wage war without first being eaten. In that respect it meets the problem in the same way as the thistle and the thorn, although it fights by subtle stealth rather than open warfare.

STEEPLE BUSH OR HARDHACK (Spiraea tomentosa L.)

(See page 594)

Close of kin to the meadow-sweet, the goat's beard, the ipecac, and the common rose, the hardhack, or steeple bush, is one of the most cheery of the pink and magenta flowers of the roadside, ditch, and swamp, blooming from July to September.

Living in territory where competition for insect favor is always fierce and the battle of the blossoms a lively one, the hardhack arrays itself in a remarkable cluster of delicate florets at the top of a two or three foot stem, which waves welcome in the swaying breezes to the insect hordes.

And that it receives its share of the business of bee and butterfly is evident to any one who will stop to count the shoppers who visit this floral department store. The bees and the butterflies are welcomed, but the plebeian ants are frowned down upon and given a chilly reception. Most of the hardhack's trade is in pollen, as its supply of nectar is somewhat limited, and as difficult to secure as are fast colors among us in these war times.

Being a dweller in damp soil, the hardhack has had to take precautions to protect itself from colds. If the under side of its leaves were not covered with woolly hairs, the vapors rising from the ground would clog their pores and interfere with their breathing. Behind the shelter of this smooth coat of vegetable fur

the steeple bush can resist changes in the weather and degrees of moisture that otherwise would be injurious, if not fatal.

Many other flowers wear their coats on the top of the leaves rather than underneath. They are usually flowers that grow out in the open and get the full benefit of the noonday sun; they would die of thirst if they did not have some way to check the process of transpiration when subjected to undue heat; hence this coat of fur.

The distribution of the hardhack is rather wide, reaching from Nova Scotia to Georgia and Kansas. It has so arranged its domestic economy that in the event the insects fail to bring it pollen from other flowers it can use its own for purposes of reproduction—a plan which it resorts to, however, only in a last desperate effort to insure itself against an unproductive life.

BUTTER-AND-EGGS OR YELLOW TOAD FLAX (Linaria vulgaris Hill)

(See page 595)

Butter-and-eggs is another flower that prefers to dwell in the open among men rather than in the forests among the trees. It inhabits waste lands, roadsides, and fallow fields, and blooms from June to October. It continues to add its orange and yellow color to the landscape until the frost comes upon the pumpkins and the fodder has been gathered into the shock. It is an immigrant, having come originally from Asia by way of Europe; but it has already spread from Nova Scotia to Nebraska and Virginia.

The butter-and-eggs is preëminently a bumblebee's flower. If other insects visit it, they have a very difficult time to persuade it to give them a sip of its nectar. The doors to its honey wells are always closed, and are so hinged that nothing but a heavy bee can push them open. The honey-bee is too light to operate them, and consequently it usually departs hungry.

When the bumblebee arrives at one of the butter-colored cornucopias holding the yolk of an egg, it alights on the lower lip of the flower, and its weight causes the door to fly open and the sign of welcome to be displayed. The bee enters, sticks its pump-like tongue down into the cup of nectar, and takes a draught. While it is doing this it is receiving in its turn a liberal dusting of pollen and depositing some of that which it received from the flower previously visited. Then it backs out, flies away to another blossom, while the door closes after the departing guest.

The butter-and-eggs has a hearty dislike for ants, and it has therefore built itself breastworks which can withstand every attack they make. It covers itself with bristly hairs, all pointing in the direction of possible invasion, and the ant armies that can successfully overcome this preparedness program are few and far between.

The plant has many qualities that protect it, among others the acridity of its juices. Housewives, in the days when everything was homemade, mixed its juices with milk, and the result was an excellent fly-poison. They also made an infusion from its leaves, which they administered to ailing chickens in the spring.

Butter-and-eggs has many aliases. In some localities it is called yellow toad flax, while elsewhere eggs-and-bacon, flaxweed, and gallwort are names used to designate it. It is a member of that numerous and prolific family, the figworts. Among its cousins are the mullens, the blue-eyed Marys, the monkey flower, and the foxglove.

COMMON MULLEN OR VELVET PLANT (Verbascum thapsus L.)

(See page 596)

The mullen is a distinguished member of the figwort family—a family that includes the butter-and-eggs, the monkey flower, blue toadflax, hairy beard-tongue, the Indian paint brush, and the wood betony.

The mullen is a lover of dry fields, banks, and stony waste lands. An old abandoned grass field is its particular preference, and it grows there in numbers that are very discouraging to the lad with a hoe who has been assigned to the task of waging a single-handed war of extermination against it. It flowers from July to September all over the northeastern part of America and in Europe and Asia as well.

Like many of its fellow-members of the figwort family, the mullen looks like something else. In some places it is called the taper flower, because its tall stalk seems a "taper tall" carried by the witches in the olden days. In other places it is called Aaron's rod, shepherd's club, and Jacob's staff.

The mullen has been with us in America so long that Europe has almost forgotten the fact that it is a native of that continent. Indeed, in the popular mind there it is a native of America. The Irish cultivate it in their flower gardens and call it the American velvet plant; but, in reality, it is an immigrant which has made itself decidedly at home on our shores. It came over as a stowaway, riding in the ballast, like many another weed that has developed the instincts of the globe-trotting hobo.

Indeed, one might trace the history of commerce by the weeds that grow along its pathways. Many plants won a footing on strange shores by riding in earth ballast in the old days, and in more modern times cattle were driven hundreds of miles to market, leaving the routes they took marked with weeds and plants more or less alien to those districts. Today railroads are active disseminators of alien vegetation, many a weed having been able to start colonies far and wide through that agency.

The mullen owes its name of velvet plant to the soft, velvety appearance of its leaves. Being forced to endure intense heat in summer by reason of its preference for an open situa-

tion on a sunny hillside, it needs some check to keep it from transpiring too freely; and being under the necessity of enduring intense cold in the winter by reason of the open, unprotected situations in which it finds itself when in the year old rosette stage, it has had to find something in the clothing line capable of acting as a sunshade in summer and an overcoat in winter.

If you examine this sunshade or overcoat—depending whether you study the plant in summer or winter—you will find it made of many minute and interlacing hairs which are equally efficient in keeping out the cold and heat.

This velvety coat has its romantic as well as its commonplace uses. We are told that rural maidens rub their cheeks with it and thus produce that peach-blossom effect that the best rouge and enamel can never give them; and also it is said that humming-birds gather the downy velvet from the leaves to make their nests.

The mullen has had many uses. The Romans dipped the stalk into tallow and used it as a funeral torch. In the Middle Ages it was used as a candle-wick by many people. It is reputed to have medicinal virtues for both man and beast, smoking dry mullen leaves and drinking mullen tea being resorted to by those having colds. It won, in England, by reason of its reputation as a healer of cattle diseases, the name of "bullock's lungwort."

SWAMP ROSE-MALLOW (Hibiscus moscheutos L.)

(See page 597)

The swamp rose-mallow is one of the largest and most gorgeous of all indigenous American flowering plants. Growing to a height of 3 to 8 feet and having a flower from 4 to 8 inches in diameter, it is a marked feature of any landscape it undertakes to adorn. Its flowering season is in August and September, and it occurs as far north as Massachusetts and as far south as the Gulf of Mexico.

It is one of that vast group of wild flowers that are truly wild, preferring to remain away from the haunts of man rather than to come out and force him to cultivate it by stealing a place among his crop plants. Rather, as if to be of service to humanity by adding its touch of beauty to spots that otherwise would be ugly, it seems to prefer brackish swamps, unkempt river banks, and unattractive stretches of lake shore.

But while it is one of the truly wild flowers, it submits without protest to domestication and very peacefully takes its place in the flower garden alongside the hollyhock, which, by the way, is its distant cousin.

It has many other cousins, some more remote and some closer than the hollyhock. The velvet-leaf mallow came from India as a cultivated flower, but so attractive was the call of the wild to it that now it belongs in the category of "escapes"; for whenever a domesticated species runs away and gets a footing of its own it is written down by the botanist as an "escape."

And it is surprising how many of the flowers we see in the field and forest have thus seemed to resent the idea that they cannot live except under cultivation. We have bred the ability to set seed almost entirely out of sugar-cane; we have practically bred the seeds out of the banana and the orange; we have so cultivated our corn and wheat and most of our garden crops that they are wholly unable to shift for themselves any longer.

But, on the other hand, there are hundreds of plants that, despite long generations of coddling, still retain enough of vitality and self-reliance not only to shift for themselves when they have to, but even to seek the chance of doing so.

The mallow is a cousin of the cotton plant, the cotton fiber being nothing less than the woolly hairs with which that plant surrounds its seeds.

Many people confound the rose-mallow with the marsh-mallow. It is indeed a marsh mallow, growing in marshy ground; but it is not *the* marsh-mallow. That mallow has a small pink flower and is an alien brought to our shores; yet it is a true American in its spirit of being useful. It is from this mallow's roots that the tasty mucilage comes which we call "marshmallow" in the commercial world.

Still another cousin of the swamp rose-mallow is the gumbo, or okra plant, so popular in the Southern vegetable garden and figuring so much in the culinary operations of the kitchen.

The mallows can point with pride to a long lineage of useful service to mankind. Even as far back as the days of Job, many wandering tribes cut up mallows and juniper roots for meat, and the Romans had a mallow which they served as a vegetable. The ancients considered the mallow a powerful medicinal herb; Pliny records this high regard by declaring that whoever eats a spoonful of mallows "shall that day be free from all the diseases that come unto him."

SPOTTED BONESET OR SPOTTED JOE-PYE WEED (Eupatorium maculatum L.)

(See page 598)

Spotted joe-pye weed is a member of the thistle family and has many aliases. In some places it masquerades as trumpetweed; elsewhere it travels under the name of thoroughwort, while in still other localities it passes as cottonweed.

First of all, spotted joe-pye asks for a moist soil. Given that, it will live either in meadow or in wood. It is a rather late-comer in the flower procession, August to September being its months. As a habitat it claims all of that portion of North America between New Brunswick and Manitoba on the north to the Gulf of Mexico and the Rio Grande on the south.

Spotted joe-pye marches through the world with head held high, having long since learned that in the flowery kingdom, as well as in the business world, it pays to advertise. Therefore

it erects a sort of Metropolitan Tower in flower land, decked with a beautiful and wonderful collection of magenta flags. Of course, no insect could miss it, and during its business season it has a host of visitors, to each of whom it offers a cup of nectar in return for a little service as a pollen-carrier.

A clever arrangement has been worked out by the spotted joe-pye weed, whereby, if there happens to be a rainy spell and the insects are not flying when it blooms, it can fertilize its own florets, and thus protect itself against the evils of race suicide in flower land.

The spotted joe-pye weed derives its name from Joe Pye, an Indian herb doctor of Pilgrim days in Massachusetts. It is claimed that he cured typhus fever with decoctions he made from this weed. It is also claimed that with it he set shaking bones to rest in ague-rent bodies; hence its name "spotted boneset."

CHICORY OR BLUE SAILORS (Cichorium intybus L.)

(See page 599)

Chicory, otherwise known as "blue sailor" or "bunk," is an alien which came to our shores "riding the bumpers," so to speak. In the olden times, when ships carried earthen ballast, many a European weed got free transportation to America. It now flowers in Canada and the eastern United States as far south as the Carolinas; and in recent years it has pushed its star of empire westward, until it includes Nebraska in its American dominions.

It is a plant that loves to dwell around the haunts of men, and never wanders very far away from them; hence the roadside and the fallow field are its favorite dwelling places. It begins to flower in July, and is one of the last to pass of that myriad throng which comes while springtime snow-banks still linger, and goes only when the biting frosts of autumn come to stay.

Chicory has long been one of the wild flowers of immediate and important use to man. The Belgians, for instance, even in the years before the great war, their incomes being too slender to justify the drinking of coffee, resorted to the chicory as a substitute; and in the days before our own pure-food laws were enacted it became such a generally used adulterant that even the adulterant came to be adulterated.

Many a pound of what purported to be roasted chicory was perhaps half chicory and half roasted wheat or barley. In a single year we have imported nearly 7,000,000 pounds of chicory root. Even under the conditions prevailing just before the outbreak of the present war we were importing about 2,250,000 pounds annually. Some people claim that chicory added to coffee imparts a flavor which makes it better than coffee in its pure state.

In Europe chicory itself is very widely used as a pot herb. The French force it and blanch it, much after our way of forcing and blanching celery, and make of it a salad which they call *barbe de capucin*.

Homer used chicory root as a part of his frugal fare, and Pliny tells us that it was one of the staple dishes of the Egyptians.

There are many denizens of the plant world close of kin to the chicory. One of these is the dandelion and another is the endive.

Somebody has said that the chicory is a peasant posy, which, opening its eyes on a cloudy day, sets its pale-blue flowers abloom, one after the other, as sparingly as the lights are kindled in the candelabra of decaying palaces. To insure its reproduction, it never allows all of its flowers to come into bloom at once. By having them bloom in installments, it is sure at one time or another to have insect visitors that will fulfill its plans.

Chicory is very methodical in its ways, keeping regular hours and being one of the leading exponents of the idea that "early to bed and early to rise" works as well in the flower kingdom as among men. It generally awakens by 5 o'clock in the morning and shuts its eyes again at 10 a. m.; but during that time it has entertained some of the most delightful insect visitors that are to be found in any community. So regular is the chicory in its habits that the Swedish naturalist, Linnæus, used it as one of the flowers of his floral clock.

BUTTON BUSH (Cephalanthus occidentalis L.)

(See page 600)

The button bush is a member of the madder family, having among its relatives the dainty bluet, the fragrant partridge berry, the ride-stealing beggar's lice, and the aromatic-berry-producing coffee-tree.

One of the first traits we notice about the button bush is its constant endeavor to keep away from mankind. Knowing that the swamp is about the safest place from human incursions that it can find, it goes there and dwells in enviable isolation.

We are prone to be selfish enough to think that the flowers' beauty and fragrance were created for our especial pleasure and edification; and yet a study of nature's flower garden reveals the fact that some of the most fragrant of the blossoms of summer shed their sweetness and pour forth their beauty in precincts far removed from man's accustomed haunts.

One of these is the button bush. With an odor as seductive as that of jasmine, it could win its way into the hearts and homes of humanity if it desired to do so; but it has no inclinations in that direction, although, like the swamp-rose mallow, when led captive it submits gracefully and grows even more attractive than before.

Its closely packed host of florets, hundreds in number, with their long styles and capitate stigmas, making it resemble a well-filled pincushion, do not remain fresh long after plucking.

The flowering season of the button bush begins in June and ends with September, and its range is from New Brunswick to Cuba and

California. It is a shrub, and grows to a height varying from 3 to 12 feet.

The button bush relies more on its appeal to the nose than to the eye of the insect world, having discovered that most insects can smell further than they can see. Only a comparatively few flowers have learned this to as full an extent as the button bush. It is said by naturalists that in New York State, which has rather a wide range of plant species, borrowing both from the northern and southern flora, there are only about thirty really fragrant species to be found.

The result of the button bush's fragrance is that, in spite of any lack of gorgeousness its flowers may show, it always has a liberal share of the nectar drinkers of the insect world. Every "pin in the cushion" has its own individual honey well, and these are so deep that a short-tongued bee or butterfly never succeeds in drinking one dry. Butterflies come first among its visitors, and after them honey-bees and bumble-bees, though wasps and carpenter bees also seek a chance cup of nectar now and then.

The button ball has learned in the hard school of experience that there is degeneracy in self-fertilization, and has therefore so shaped its household economy that self-fertilization cannot take place. The power to produce pollen is lost by its anthers before the power to receive it is developed by its stigmas. Thus the pollen produced by a given set of anthers is not available for their companion stigmas, but must be transferred to those of some other flower.

In many flowers self-fertilization is prevented by the maturing of anthers and stigma at different times, just as is the case in the button bush; others have the stamens curved outward and away from the stigma. Still others have found still other ways equally ingenious and equally effective for the same end (see also fringed gentian, below).

And so it is that we see flowers ascending the scale of existence, ever laboring to improve their race, ever striving for a higher and better existence, ever seeking so to live and so to act that they will be able to bequeath to their posterity strength and fitness to survive.

Through the centuries fate goes on and on weeding out the unfit in flower land and teaching its inhabitants that the path to excellence is the only sure road to survival.

FRINGED GENTIAN (Gentiana crinita Froelich)

(See page 601)

The fringed gentian lives in low, moist meadows and woods, and begins to blossom when most of its fellows of the flowery kingdom have gone to seed and to death. One meets the fringed gentian from Quebec to Georgia, and as far West as the region beyond the Mississippi River.

When this handsome but late comer arrives even the birds have nearly all flown and their songs are only a memory, while the color of autumn is largely that of leaves which have arrayed themselves in the bright-hued garments in which they bid their parent trees farewell. It seems, indeed, that the poet was right who wrote that the fringed gentian comes with its merry blue to cheer the melancholy days that portend the passing year.

In order to insure the production of a full supply of fertile seeds, it has adopted methods insuring it against self-fertilization. The stamens mature and lose their power to fertilize before the pistils are developed, and it thus saves itself from that harmful inbreeding to which only flowers low down in the scale of floral existence resort (see also button bush, page 588).

The fringe of the gentian adds grace to it, but that was not the flower's thought in providing the fringe, for even the most lovely of flowers is utilitarian in its instincts. The ants long generations since developed a fondness for the nectar of the gentian; great hordes of them overran it and drained its nectar cups. But, since the flower had taken precautions to insure cross-fertilization, it could not afford to have the ants pilfer the nectar which was the currency with which it rewarded the bees and butterflies for their assistance in its new plan of fertilization. Therefore, like the butter-and-eggs (see page 586), espousing the cause of preparedness, it developed a system of defenses against ant invasions that is remarkable alike for its thoroughness and its beauty.

There are many kinds of preparedness in the plant world other than that used by the fringed gentian and the butter-and-eggs. Some plants secrete a milky juice which exudes whenever the plant is injured and which usually covers the invader with a touch of raw india-rubber. Others secrete resins, such as turpentine. Others supply themselves with a defense of tannic acid, while still others manufacture poisons, or have strong scents, like lavender and mint, or spines like thistles, or thorns like roses (see also poison ivy, page 585).

Some even go so far as to make friends with certain kinds of fierce ants, which keep the leaf-cutters away, as in the case of the South American acacia. The latter employs a species of police, or a standing army, of ants to keep off injurious insects or larger animals. The plant has hollow thorns, and upon the tips of its leaflets there are small projections full of sugary material. The hollow spines are inhabited by colonies of fierce soldier ants, which swarm out and drive off any insect enemy. They are fed, or "boarded," on these sweetish projections.

BUTTERFLY-WEED (Asclepias tuberosa L.)

(See page 602)

This hardy American, like many another wild flower, has no taste for the solitude of woods and marshes. Rather, it prefers to add its touch of color to the roadside, the dry or sandy field, and the hills. It loves to watch the world

go by and to cheer the passing throng with its brilliant orange-red flowers, its green leaves, and red stalk.

Nor is the butterfly-weed stingy with its favors, for June finds it decking itself with its splendid array of flowers; and only in September does it doff its georgeous colors.

The butterfly-weed sweeps in stately grandeur from Maine and Ontario to Arizona and the Gulf of Mexico.

Weed it may be to us, but sweetest inhabitant of nature's flower garden it is to the myriads of butterflies, for whom it is indeed a "land flowing with milk and honey." The high and the low, the rich and the poor, the great and the small—prince, noble, and pauper alike—come to its table. Here is the exquisite half-moon-winged swallow-tail, touching elbows, as it were, with the scrubby little cabbage butterfly, and the elegantly attired spice-bush swallow-tail sipping from a cup next to the one which the little old mud-puddle "yaller" butterfly is draining.

This flower, like its kinsfolk of the milkweed family, has a marvelous mechanism for forcing its guests to pay well for their board.

The alighting place where these animated aëros effect their landings is decidedly smooth and slippery, and the arriving guest finds himself on a surface which makes a newly waxed ball-room floor seem like a stony pathway in comparison. As he does a combination of the tango, the fox trot, and the jig trying to find a stable footing, one foot, or mayhap two, slips into a little slot, which holds fast. While wriggling around to get loose, his foot slips down farther into the slot. A sharp jerk releases the foot, if the insect is strong enough, but not until a little pair of pollen saddle-bags has been bound to it. Bumblebees sometimes get away from a plant with half a dozen of these little saddle-bags hanging to their legs.

At the Centennial Exposition at Philadelphia, in 1876, a bed of beautiful flowers brought over from Holland won the admiration of many thousands of people; and yet they were only a Dutch edition of our own butterfly-weed.

The Indians used the butterfly-weed's root in treating pleurisy, and made a crude sugar from its flowers. They used the young seed pods in the cooking of buffalo meat much as we might use green peppers with chicken or hash.

JACK-IN-THE-PULPIT (Arisaema triphyllum (L.) Torr.)

(See page 603)

Jack-in-the-pulpit is one of the denizens of flowerland that seldom ventures out of the forest. It loves wet, marshy ground, blossoms from April to June, and claims as its own all of that vast territory from Nova Scotia westward to Minnesota and southward to the Gulf of Mexico.

Jack is a member of a numerous family, among its relations being the stately calla lily, loved by all who appreciate beauty and grace, and that black sheep of flowerland, the skunk cabbage.

What country boy has not been tempted into tasting of "Indian turnip root," to his sorrow and to the great burning of his mouth? And why should he not suffer, for that root which has been ruthlessly torn up represents the hard-earned savings of Jack-in-the-pulpit. During the happy days of the summer-time Jack labors hard to pay the premium on his life insurance, so that in the spring to follow, when he is dead and gone, his heirs may rise up possessed of a "grub-stake" that will provender them until they can win their own place in the world. Many plants thus insure their lives in behalf of their posterity, giving every bit of their surplus income over to a root-stock fund for their children.

Jack-in-the-pulpit got his name through the resemblance of the little hooded house of green which he builds to the old-time pulpits, which had a sort of hood over them.

He received his name of "Indian turnip root" through the fact that the Indians habitually raided his root-stock insurance, and, boiling the "bite" out of it, made of it what they considered a delectable dish.

Another cousin of Jack's, as stated before, is the skunk cabbage, which has the painful habit of smelling bad; and yet there is method in its madness, for it is an insectivorous flower. It tries to simulate the odor of decaying meat in order that all of the flies, the big blue-bottle ones and all their neighbors, may be attracted its way. As soon as it gets them, it lays hold of them, and makes a feast of them instead of for them. It is strange that a family with such a noble head as the calla lily could possess a sheep so black as the skunk cabbage, and it is equally strange that the floral procession of the year should be headed by this evil-smelling representative of the flowery kingdom.

Jack-in-the-pulpit is gradually copying the ways of the most disreputable member of his family, instead of trying to live up to the beautiful reputation of his fair cousin the calla. He has so arranged his pulpit that once a tiny fly or ant or bee gets in, it has mightly little chance to escape. A bear was never more firmly held by the jaws of a big steel trap than are the bees in the little green trap which Jack sets.

YARROW OR MILFOIL (Achillea millefolium L.)

(See page 604)

The yarrow is a member of the thistle family, though it defends itself from the attacks of grazing animals by its odor rather than by pricking spines. It is true that it has incipient spines in the shape of bristly hairs, but these are not stiff enough to do any damage.

Yarrow has as many different names as a modern Raffles. Some call it milfoil, crediting it with having a thousand leaves, just as rural folk credit a centipede with being a thousand-leg worm. Others call it "old man's pepper," by reason of its spicy aroma, and others nosebleed, by reason of its nosebleed-producing qualities. Still others call it soldierwort, by

Forget-Me-Not
Myosotis scorpioides L.
591

VIRGINIA CREEPER
Parthenocissus quinquefolia (L.) Planchon
Contrast it with the dangerous Poison Ivy on the next page

Poison or Three-Leaved Ivy

Toxicodendron radicans (L.) Kuntze

Contrast it with the harmless Virginia Creeper on preceding page

Steeple Bush or Hardhack
Spiraea tomentosa L.

Butter-and-Eggs or Yellow Toad Flax
Linaria vulgaris Hill

Common Mullen or Velvet Plant
Verbascum thapsus L.
596

Swamp Rose-Mallow
Hibiscus moschcutos L.
597

Spotted Boneset or Spotted Joe-Pye Weed
Eupatorium maculatum L.

Chicory or Blue Sailors
Cichorium intybus L.

Button Bush
Cephalanthus occidentalis L.
600

Fringed Gentian
Gentiana crinita Froelich
601

Butterfly Weed
Asclepias tuberosa L.
602

JACK-IN-THE-PULPIT
Arisaema triphyllum (L.) Torr.
603

YARROW OR MILFOIL
Achillea millefolium L.

FIRE WEED OR GREAT WILLOW-HERB
Chamaenerion angustifolium (L.) Scopoli

New England Aster
Aster novae-angliae L.
605

Wild Yellow or Red Plum
Prunus americana Marsh.

reason of its efficacy as a homely remedy in the treatment of wounds.

It derives its official Latin name from the Greek warrior Achilles. We are told that Chiron, the centaur, taught its virtues to the defender of ancient Troy, who made from it an ointment with which to heal his wounded myrmidons.

The yarrow is widely used in the remote rural districts as a love charm. A girl wraps it in flannel and puts it under her pillow, repeating a verse. The next day she puts it into her shoe and asks it to guide her footsteps to her future husband. The first single man she meets is supposed to be the one it recommends to her.

When is a plant a flower and when a weed is a question that often has been asked. Some one has called a weed a vegetable vagabond which adds to the vice of idleness the good-for-nothing trait of mischievousness.

The yarrow is a charming flower to some. To the city-born it is an exquisite, lacy flower, so much so that it is sometimes cultivated. In the Azores it is cultivated as the lace plant, and one writer reports having seen it growing on the lawn of an exclusive home on Fifth avenue, New York. But to the farmer whose hay-fields it invades, and to his sturdy sons who must work many a hot summer day to keep it from running away with the farm, it loses all its poetry and romance and grace and becomes a living sign of a poor farmer—a weed of the worst type.

When one considers how the yarrow chooses the grass fields as its favorite habitat and makes the farmer help to propagate it by cutting it with his hay, and thus scattering its seeds far and wide, he cannot but reflect upon the wonderful determination with which it fights extermination.

Indeed, the more "pestiferous" a weed is to a farmer, the greater have been its achievements in the way of overcoming obstacles. One would admire greatly their gameness, their generalship, and their spirit of "facing their fortunes like a man" were not their triumphs the farmer's defeats.

Take purslane, lambs quarter, and a dozen other weeds. They need cultivation to thrive well, so they steal into garden and truck patch and compel the gardener to cultivate them while he cultivates his vegetables.

Then there is corn cockle, "croutweed," garlic, and innumerable other weeds which like nothing better than to get into a wheat-field and get cut along with the wheat. The farmer must thresh them with his wheat, and thus they get sown in well-prepared soil once again.

Nearly all the weeds have learned to fit themselves to those farm operations which are best suited for their spread. That is the reason that yarrow gets such a firm hold wherever it goes. The farmer cannot "make hay" without "making yarrow," too.

The insect world likes the yarrow if the farming population does not. More than 120 species of bees and butterflies visited a watched plant in a single day. Its nectar stands seem as popular in insectdom as the pink lemonade stand at a circus or a soda fountain at a corner drug store on a hot day.

GREAT WILLOW-HERB OR FIREWEED (Chamaenerion angustifolium (L.) Scopoli)

(See page 604)

Nature appears to detest ugliness as much as she abhors a vacuum, and seems to have created the fireweed as an antidote for one of the ugliest sights a landscape may offer—burnt-over ground; for it is first and foremost among the flowers to labor for the blotting out of these inkspots upon the carpet of the earth.

The fireweed deserves its name, for it seems to be a real Phœnix among the flowers, rising out of the ashes in green and pink robes as though the flames had been its friends.

It takes to the fallow field and the dry roadside when it cannot find a burnt district to cover, and begins to blossom with the coming of June, and only with the passing of September joins the somber host that marches to its doom when Jack Frost turns executioner with the cutting cold as his ax.

A genuine cosmopolite is this "first aid" to burnt-over Nature, for it is not only at home in America from the Atlantic to the Pacific and from Canada to the Carolinas, but also in Europe and in Asia. It belongs to that extensive family of which the evening primrose is the name-giving member, and of which the primrose willow, the long-stemmed sundrop, the fuschia, and the enchanter's nightshade are distinguished representatives.

The scheme by which the fireweed saves itself from the evil of self-fertilization is the same as is used by the button bush (see page 588), the holding back of the styles from maturity until such time as the pollen from the flower's own anthers is gone. As soon as that happens the down-curving styles bend upward, so that no bee or butterfly that has come to them from another flower can get a single sip of nectar without first giving them numerous grains of pollen dust in exchange.

What a lesson for men in the relations of the bees and butterflies with the flowers! There is keen competition and lively bidding for insect favor, but there are neither strikes nor price-cutting wars. A sip of nectar for a dash of pollen has been for countless generations the ruling quotation. Both flower and insect are satisfied with the bargain, and each passes through the years glad that it can be of service to the other and happy that the other can serve it so well.

The first instinct of every flower is so to live that when it dies it may live again, not in its own being, but in generations of sturdy progeny. Innumerable are the expedients which they employ to bring about that happy result.

Some of them, like the rose of Jericho, pack up bodily when the dry winds of the desert come along, and roll before them, root and branch, until they strike some moist place,

where they unpack and start life again. Others tie sailor knots or make elastic springs. When the seeds are ripe, these stretch like a rubber band, break, and catapult the seeds like a pea-shooter.

Still others put hooks in their seeds, so that they can send them far and near by stealing rides on animals, such as the cockle bur. And then there are others that were perpetuating themselves by their mastery of the principles of the parachute countless generations before man dreamed of a balloon.

Among these latter is the fireweed. It has a slender, curved, violet-tinted pod in which are nested numerous seeds, each attached to a tuft of fluffy, white, silky thread. When the seeds are ripe, the pod bursts open, and as the winds come along they start the little seed-laden parachutes a-sailing through the air to destinations whose distance is limited only by the velocity and the duration of the wind.

And so it sends its children far and wide, hoping that each one may land in some hospitable spot, ready with the advent of another summer to become, in its turn, the founder of other colonies.

NEW ENGLAND ASTER (Aster novae-angliae L.)

(See page 605)

Like its cousin the thistle, and like the daisy and the sunflower, the aster is one of the most civilized of flower peoples; so well have they adapted themselves to the necessity of varying environment that they have been able to travel around the earth and to make themselves at home wherever they go.

They ask odds of nobody. Through countless generations they studied the best methods of insuring their survival against the fiercest competition, and finally developed the idea of the composite flower. It was like a Forty-niner striking a bonanza mine! And so we find them wholly self-reliant, self-sufficient, and ready to fight all comers for their right to a place in the sum of existence.

When they started out they were like the grass—dependent upon the wind to carry their pollen; but as they journeyed down through the ages they gradually discovered that the wind was not always a trustworthy messenger. The more progressive among them decided to employ insects instead of breezes as their pollen-bearers.

Their first "help wanted" advertisements were a few dainty flower petals, but this innovation was so successful that they began to do a land-office business. They found that myriad armies of insects were ready to be mustered into their service.

So successful indeed was the experiment that they decided to extend their business still further, and to employ in their appeal for recruits display ads in the shape of great groups of flowers instead of want ads in the shape of isolated blossoms.

And their second adventure was as successful as the first. They offered high wages in easily reached and abundant nectar of the best quality, with the result that they were able to command the services of the most reliable of the messengers of all insectdom.

Their brands of nectar were so well advertised and maintained such a high standard of purity that their big page ads drew vast hordes of winged Mercuries, and, having become the biggest users of printers' ink in flower land, their respective establishments grew and grew until their names became household words in insectdom.

Today they are the captains of industry, the Napoleons of finance, and the people with a vision of flower land. The daisy army transforms millions of acres into white and gold in summer, while in autumn the aster and golden-rod proclaim their triumph through millions of acres of yellow and blue.

There are about 120 species of asters in the United States. The New England aster, the subject of this sketch, is one of these. It occurs most frequently in New England, as its name implies; but it has been extending its territorial possessions somewhat, and now occurs in the maritime provinces of Canada and as far south as the Gulf of Mexico. Its flowering season is from August to October, and its favorite habitat swamps, moist fields, and roadsides.

WILD YELLOW OR RED PLUM (Prunus americana Marshall)

(See page 606)

With a flower as fair as any that blooms, even though it is but a small blossom, and fruit that, with its rare transparent coloring, is the soul of beauty, the wild yellow or red plum has a host of friends who rate it high in the order of things delightful to the eye.

This plum is a genuine American, having dwelt here even before the legendary Norsemen came to these shores. And it is of such sturdy stock that it has been widely used to give new life and to infuse new hardiness into the effete plums that have come to us on the wings of commerce from Europe.

Since the scientists have become masters of the art of cross-breeding trees and plants, they have learned to couple the hardy, self-reliant, disease-resisting traits of the wild species with the improved fruit-producing traits of the tame varieties that have come to it through centuries of selection. In that way they have given us a long list of new and improved plants.

They go to the desert for clovers to cross with our ordinary stock and give us drought-resisting pastures; they go to Peru for "new blood" for our potatoes, and we get hardier varieties than we had before; they take the hardy Japanese bitter orange and cross it with the domesticated orange and get a wider area for its cultivation.

And so the wild plum has been made to do duty in the development of a dozen or more

varieties of cultivated plums. Its range is from the Atlantic coast west to the Rocky Mountains and south to the Gulf of Mexico. It blossoms in April and May and bears fruit from August to October, preferring to grow in narrow, open woods and along the borders of streams.

The plums are distinguished from the peaches through their smooth coats and their unwrinkled seeds. It is a curious fact that the varieties derived from the wild yellow or red plum and its related American species, and also the Japanese plum, are practically sterile to their own pollen, and do not produce profusely enough for profitable cultivation unless within reach of other varieties for cross-fertilization.

The plum has its own peculiar enemies, both fungus kind and insect kind. One sort of fungus which attacks it begins its work soon after the plum sheds its bloom, and as the fruit begins to grow it develops a "plum-pocket" an inch or two long, which presents a hollow, bladder-like appearance. The attacked fruit develops with thickened walls, but with no pit. The fungus also attacks the leaves and stems, causing them to assume a bloated, distorted appearance.

The insect which is the especial enemy of the plum is the curculio, a small, rough, grayish black beetle about one-fifth of an inch long and with two peculiar bumps on its back. The female selects a plum in which to deposit an egg. With her little snout she makes a short slit about one-sixteenth of an inch deep and places her egg therein. Then she cuts another slit, crescent-shaped, in front of the other one, in such a way as to cause that side of the plum to wither and to prevent the fruit from healing up around the egg.

When the larva hatches out, it feeds on the fruit around the stone until the plum, now thoroughly diseased, falls to the ground, carrying it along. It then climbs out of the fruit, digs down about a third of a foot into the ground, and there makes a little cell in which it transforms itself into a pupa in from three to six weeks. As an adult it emerges, selects a place for hibernation, and sleeps until next year's trees begin to bud, feeding on twigs and buds until the fruit begins to form.

THE CITIZEN ARMY OF HOLLAND

By Henrik Willem Van Loon

Author of "The Fall of the Dutch Republic," "The Rise of the Dutch Kingdom," Etc.

THE Holland with which we are all familiar is a picturesque combination of dikes and windmills, smiling girls with pretty lace caps, and very small boys with very big cigars. There is another side to this picture to which we have paid less attention; that is the Holland of the modern merchant and the modern scientist — a small bit of land teeming with industry and busy with a thousand different affairs—a country administering a vast colonial empire without the use of a large military establishment and capturing Nobel prizes at a most enviable rate.

This modern Kingdom, with its harbors and its vast foreign trade, forms a small but concise national unit in the midst of very powerful neighbors, who for over two years have been engaged in the most gigantic of all wars. Yet Holland has managed to keep out of the struggle with lasting success. It was able to do this because in a military sense it was fully prepared for all eventualities.

A COMPARISON OF BELGIUM AND HOLLAND

The Kingdom of Belgium was not prepared for war and it was invaded and overrun by a hostile army. The Netherlands, although smaller in number of inhabitants, had the entire arm-bearing force of its male population at the frontier 48 hours before any of the other nations of Europe mobilized. As a result, the neutrality of the country has been rigorously respected.

Strategic reasons, however, for an invasion of the country have been present ever since the month of October of the year 1914, when the Germans captured Antwerp. A cursory glance at the map will show that the Germans thereby acquired the most important naval base in their warfare upon England. Yet they could not use it as long as Holland closed the mouth of the Scheldt with mines and gunboats and land fortifications.

Upon several occasions there was an uneasy and panicky feeling that the Ger-

QUEEN WILHELMINA INSPECTING THE WORK OF HER EXPERT DETACHMENT OF ENGINEERS

man armies might try to force the mouth of the Scheldt and make Antwerp a naval port for the benefit of their submarines and warships. During many anxious weeks the people of the Netherlands have had the unpleasant sensation that the General Staff of the German armies was figuring and computing the exact debit and credit side of a violation of Dutch territory. Often it seemed that the next morning might bring the news of a German invasion. But every time thus far the careful accountants of the efficient Imperial Staff must have come to the conclusion that an invasion of Dutch territory would cause more harm than good. The troops which had been massed on the southern frontier of Holland disappeared; the guns went rumbling back across the heavily paved roads of Flanders, and the port of Antwerp remains closed to this day.

The activity of the Dutch army, however, has not been directed exclusively against the eastern neighbors. Holland knows that it would provide an excellent thoroughfare to the Rhine region and the steel works of the Krupp family; therefore every quarter mile of the entire coast is guarded day and night. The sand-dunes, which provide a wonderful natural barrier, have been fortified with hidden guns and well-covered positions for machine guns. The towns and villages situated behind the dunes are well garrisoned, and an excellent system of roads running parallel with the coast enabled the Dutch Government to transport artillery and infantry to any threatened spot within less than an hour. Torpedo boats and a flotilla of submarines patrol the coast at all times. Thus far they have been able to save the lives of many shipwrecked sailors, but they have not been called upon to do active service.

FIREPROOF THOUGH SURROUNDED BY FIRE

All this is in keeping with the heavy sacrifices which the Dutch people have for years made for the defense of their country. They do not intend to use their army for any purpose of aggrandizement; they do not expect that the few hundred thousand men which they are capable of bringing into the field will ever decide the fate of Europe; but they intended to create an army and a navy of such strength that any enemy who should wish to attack the small country would be obliged to reckon the cost before he dare to make the attack.

They made a soldier of every man capable of bearing arms. They prepared the principal part of the country for immediate inundation, and then quietly made it known to their neighbors that they would regard a nation which should cross their frontier as their enemy.

The result thus far has been beneficent to the small Kingdom. The conflagration has spread to all parts of Europe. This little triangle of sand and marshes, situated right in the middle of the terrible upheaval, has been spared. Unless unforeseen circumstances shall happen, Holland will not take part in the war. The outlay of countless hard-earned millions and the willingness of all men to submit to a few months of drill has accomplished this feat.

Together with Switzerland and Denmark and Norway and Sweden, Holland owes its salvation to its own labors and sacrifices. It was a lesson which was not easily learned, but which will not lightly be forgotten after the terrible example of Belgium.

THE TRAGIC LESSON BEQUEATHED BY OLD HOLLAND

It is a sad reflection that just one hundred years ago Holland was in the same position in which her southern neighbor finds herself at the present moment. The old Dutch Republic of the sixteenth and seventeenth centuries had grown too rich in the eighteenth century. Millions for tribute, but not a cent for defense had become the watchword of the self-contented rentiers, whose grandfathers had amassed fortunes and who were not willing to spend a penny of their comfortable dividends upon either an army or a navy. Whenever they needed soldiers they hired a few regiments of Germans or Scotchmen. They allowed the ships of the navy, which had made their country the leader of Europe's foreign policies, to rot in the harbors, and for over forty-three years did not spend a guilder for the maintenance of the fleet.

DUTCH CAVALRY IN A PRACTICE MARCH

DUTCH ARTILLERY FORDING A SMALL RIVER

This is the only regiment which retains the old Napoleonic bearskins. It is a regiment of light artillery. It operates in the territory which is most exposed to attack, and its duty is to defend the rivers which run toward the North Sea and the Zuyder Zee.

A MOUNTED MACHINE GUN CARRIED BY TWO HORSES THAT JUMP AS ONE

In modern warfare machine guns have become almost as plentiful as rifles. The cavalry horses of Holland are trained jumpers, for to be most useful in the defense of the country they must be able to jump canals readily.

Several times the government of the Republic was called upon to fulfill the stipulations of some ancient treaty of alliance and to provide her friends with a certain number of ships and a few thousand men. Instead of sending ships, the Dutch Government produced an unlimited checkbook, made some sort of humiliating compromise, and bought herself out of all honorable engagements.

When the Dey of Algeria captured Dutch ships trading in the Mediterranean, he was offered an annual bribe if he would desist from bothering Dutch commerce. When British privateers burned Dutch fishing smacks off the coast of Zeeland, the people rushed into print and denounced the wicked Englishmen. But nobody thought of fighting these enemies as their fathers had done.

It was a sad story. The less we say about it the better. The reward for this policy of indifference and cowardice came in the year 1795. In less than a week the entire Dutch Republic of mighty memory fell into the hands of the French revolutionary hordes. Holland in the sixteenth century had been a large business house defended by a mighty fleet. In the eighteenth century it became an opulent savings bank, which refused to provide for a new door and new shutters because "it would cost too much." The French revolutionary soldiers, soon followed by Napoleon the First, pushed their way into the treasure-house of this feeble Commonwealth, declared it to be part of the French Empire, removed everything of any value, and after twenty years of systematic pillaging they turned the erstwhile powerful Republic into a geographical idea, without men, without money, without hope, and without courage.

When finally, on the nineteenth of October, 1813, old Blücher, cursing and swearing at the Corsican usurper, forced his way into the city of Leipzig and turned the French defeat into a rout, there were not more than a dozen men in the former Republic willing to risk their lives for the liberty of their country. It is a matter of record that during the first week after the flight of the French troops from Holland the regular Dutch army did not count more than 651 men.

From that moment, however, there was a steady improvement. The Kingdom of the Netherlands was formed, under the leadership of the old House of Orange. Every man capable of bearing arms was drafted into the national defenses, and much of the ultimate success of the battle of Waterloo was due to the Dutch forces at Quatre Bras, who engaged the superior advance guard of Marshal Ney until the Duke of Wellington had put his army into battle array.

EVERY BOY IS TRAINED TO DEFEND HIS COUNTRY

From the year 1815 on, every boy of nineteen in the Kingdom has been obliged to prepare for military service. It is not desirable to give the exact number of soldiers in the army which has been mobilized since July of the year 1914. But in a general way we can state that every male being in the country who is of good physical condition and who can walk with a gun across his shoulder has in some direct or indirect fashion given part of his time and his services for the benefit of his country. The old law, which made an exception for only sons, was rescinded several years ago. The Napoleonic system, which allowed rich young men to buy themselves out of the army, has been abolished. The army is now a democratic school, in which classes are thrown together for one common purpose.

Every young man who has reached the age of 19 years appears at his special garrison. For a full year he is instructed in the rudimentary principles of a soldier's trade. If he cares to enter the special service of artillery, aircraft, or submarine work, he will have to spend one or two years more. In that case, however, he learns a useful trade which will help his chances in his future work.

When he has been taught his business he goes back into private life. Except for a short annual maneuver, he has nothing further to do with the military system until a sudden emergency shall call him back to the colors.

THE NORTH SEA IS HER BEST ALLY

Holland can hope to accomplish great things with comparatively weak forces,

THE DUTCH CYCLE COMPANY ON THE MARCH

In addition to its infantry, artillery, and cavalry, the Dutch army has a "bicycle brigade," a company of men who are noted for their ability as riders and marksmen. It is their duty to destroy all bridges in case of invasion (see page 617).

because it has an ally, mightier than either steel or iron or high explosives. That ally is the North Sea. The Kingdom of the Netherlands is a mud-bank conquered from the ocean. Open the dikes which defend the land against the angry aggression of the sea and the country will disappear beneath 3 feet of water. This excellent method of defense was known to our ancestors. It was first used in the year 1572. In the month of April of that year a number of starving Dutch revolutionists captured a small Dutch town named Brielle. The Spaniards tried to reconquer it. The Hollanders opened the locks of the Meuse. The water came and the Spaniard went.

A few years later the town of Leiden, situated in the heart of the country, was delivered from Spanish siege by a fleet of Dutch catboats and flat-bottomed scows sailing across an impromptu lake and storming Spanish forts after a charge of swimming and wading sailors.

A century later the entire military power of Louis XIV of France was turned against the Dutch Republic. The French army, fresh from victories in many parts of Europe, came to grief when William III inundated the principal part of the Province of Holland and threatened to drown the invader.

In the year 1815, when the new Kingdom of the Netherlands was definitely reconstructed, it was decided to use the water in a scientific fashion for the defense of the country. The eastern part, flat and covered with heath, was to be left open to invasion. The heart of the country, 9 feet below the level of the sea, was to be turned into an ingenious fortress.

At the present time the old idea has been continued with but small changes. A strong force of cavalry and infantry provided with bicycles is left for the defense of this territory. These men must try and stop the invading power as long as possible. It is their duty to destroy all bridges and to dispute any attempt of the enemy to cross the big rivers.

HOLLAND IS SURROUNDED BY MOATS

Meanwhile the regular army has retired behind the system of fortresses and inundations, which are all together designated as the "Waterline."

The "Waterline" consists of two parts. The first line of defense runs from the Zuyder Zee due south to the lower parts of the rivers Meuse and Rhine. It cuts off the provinces of north and south Holland and half of the province of Utrecht. It creates a large artificial lake, from 6 to 10 miles wide, which covers all roads, canals, bridges, railroad tracks, and fences.

In many places where an attack might be expected barbed-wire fences have been constructed in such a fashion that they shall be completely covered by the water. The few trenches which guard this line of defense on the east can be turned into ditches. It will offer the forlorn aspect of a large tract of flooded territory. The thousands of trees, the network of fences just below the surface of the water, will make navigation an impossibility.

At irregular intervals there are more than 40 little islands armed with heavy guns. They cover all the roads which in normal time cross this territory, and they know the exact range of every foot of ground (or rather mud) in the waterline.

Behind this first line of defense stretches the second one, which is also the most important. It consists of another group of inundations and some forty-eight fortifications, and forms a broad circle of defense for the town of Amsterdam. Here the strength of the country has been concentrated, and ever since the beginning of the present war every lock and every dike has been guarded. Within six hours this territory would be ready to resist an invasion. Within twelve hours thousands of acres of the most fertile grazing grounds would be covered with four feet of salt water. After a day and a night neither man nor machine could cross the artificial sea surrounding the heart of the country. The much dreaded shells of the heavy siege guns would cause a big splash, but would do no damage.

This is not a mere supposition written in a moment of patriotic self-glorification. Our statement is based upon the German experience along the Yser front. The

DOG AND MAN ALIKE MUST PULL IN DEFENSE OF HOLLAND'S DUNES

The Dutch sowed a sand grass upon the dunes and bound their shifting sands; and now the dunes are ramparts of defense. They dammed back the seas and, foot by foot, won much of their territory from the ocean, which nevertheless protects them from human foe, because no nation has soldiers tall enough to keep their heads above water should the sturdy Hollanders call the seas to their aid.

WAR DOGS AT WORK IN HOLLAND

Dogs have always been used in the low countries for the transportation of light carts or the towing of ships in canals. These machine-gun dogs, a special variety which is being bred for this sort of work, resemble Eskimo dogs in their vitality and high spirits. They keep cheerful and good-natured long after the human machine has yielded to fatigue.

HEAVY ARTILLERY PASSING THROUGH THE CANALS OF HOLLAND

The coast is defended strongly, the works barring entrance to the Zuyder Zee and to the Amsterdam and Rotterdam canals being of the highest art in military engineering

A PORTION OF HOLLAND'S AËRIAL FLEET AT SCHEVENINGEN

Just as Switzerland has remained an island of peace in a sea of war, so Holland remains an oasis of happiness in a desert of carnage

southern part of Flanders, in which the heaviest fighting of the year 1914 occurred, greatly resembles the watery part of the Netherlands. It is a region of low pastures and high skies, ditches, rain, and salt spray. The opening of the locks at Nieuport flooded the land on both sides of the Yser Canal. Behind this the remains of the Belgian army were able to withstand the first shock of the German army marching for Calais.

After almost two years of patience and ingenuity, the Germans have not advanced a single yard against this stagnant lake, which is now the burying ground of many thousand young and brave fellows. The ordinary methods of war were of no avail. Boats, floats, complicated rafts have all been tried and have been given up as useless. The remaining part of Belgium is safe behind this bulwark of our faithful old ally, the North Sea.

The people of the Netherlands know that they will exist as an independent nation just as long as they are able to take care of themselves. For this purpose they have made it the duty of every man to give part of his time to the service of his country. For this ideal they are willing to sacrifice the better part of their territory and to surrender it temporarily to the waves rather than allow an occupation by the force of an enemy.

Because of their industry and foresight in preparing themselves for the unexpected, no hostile force has crossed the frontiers of their tiny country during the last one hundred years.

Photograph by George R. King

A SCENE IN SIEUR DE MONTS NATIONAL MONUMENT, MT. DESERT ISLAND

A wild sheet of water that fills the deep glacial gorge of Indian Pass and lies between the Gates of Eden

Photograph by George R. King

VIEW TAKEN ON THE BEACHCROFT PATH, MT. DESERT ISLAND

Built as a memorial to an island home and leading boldly up the pine-clad ledges to Huguenot Head and a glorious ocean view

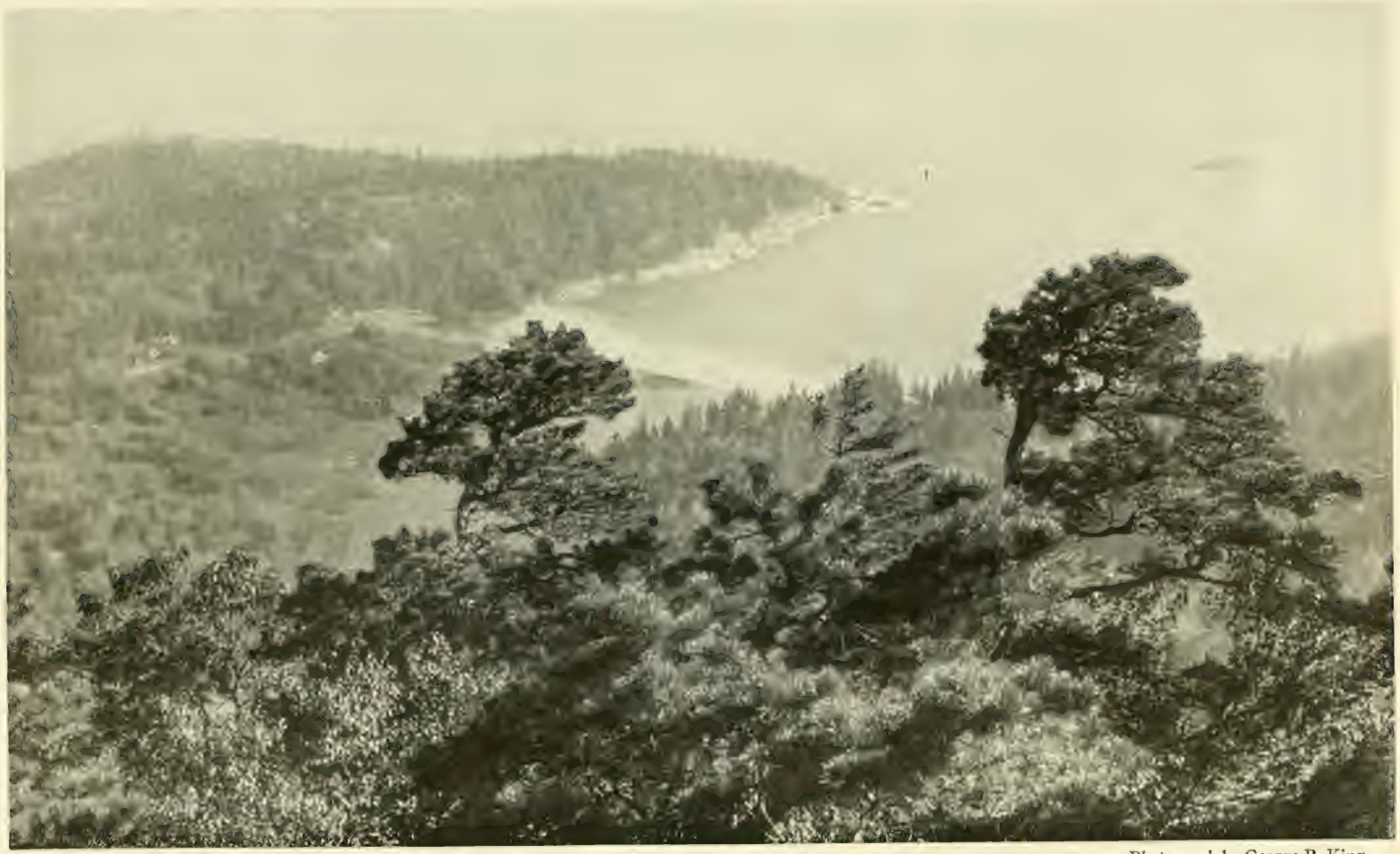
FIRST NATIONAL PARK EAST OF MISSISSIPPI RIVER

In the July issue, 1914, of the NATIONAL GEOGRAPHIC MAGAZINE appeared a group of articles by Charles W. Eliot, President Emeritus of Harvard University; George B. Dorr, E. H. Forbush, and others, telling of the intended gift to the Nation of a National Park upon Mount Desert Island, the culminating point of the beautiful coast scenery of Maine. After two years of further work upon the donors' part, spent on the improvement of boundary, approach, and title, this gift of unique and splendid landscape character has been accepted by President Wilson, and now stands dedicated forever to free public use and to purposes of bird and other wild life conservation, under the title of the Sieur de Monts National Monument.

Its acceptance marks the beginning of a new era in our National Park development, it being the first National Park—apart from battle monuments and forest reserves—to be established in the vast and wealthy eastern region of our country—the region of early occupation, of densest population, and greatest public need.

Photograph by George R. King

VIEW FROM THE SUMMIT OF NEWPORT MOUNTAIN: LOOKING NORTHWARD ACROSS FRENCHMANS BAY TO THE GOULDSBORO HILLS



Photograph by George R. King

VIEW OF GREAT HEAD AND THE SAND BEACH, TAKEN FROM THE HOMANS GIFT, MT. DESERT ISLAND

A superb headland bounding on the south the National Park. The beach below and rocky shore beyond were bought some years ago by the late J. Pierpont Morgan and given to one of his daughters, whose summer home it is, but who generously leaves the old-time path across them open to the public.

Photograph by George R. King

THE PRECIPITOUS GRANITE CRAGS OVERHANGING SIEUR DE MONTS SPRING

Our first National Park east of the Mississippi River, the Sieur de Monts National Monument, was the first land to be visited, described, and named by Champlain when sailing under de Monts' orders in the exploration of the New England coast.

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